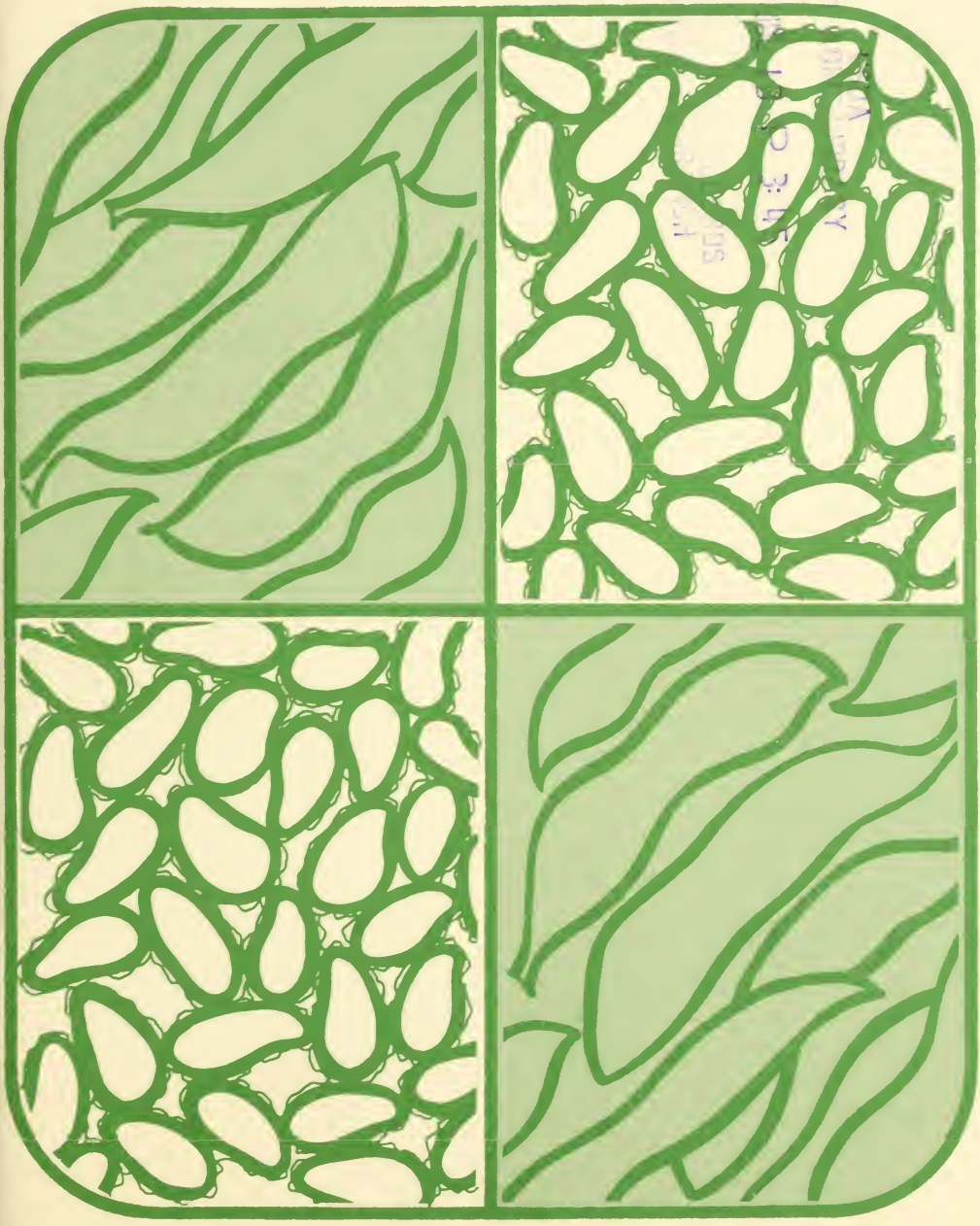
FCS Information 75

GROWTH OF COTTONSEED AND SOYBEAN PROCESSING COOPERATIVES

Farmer Cooperative Service
U.S. Department of Agriculture



Farmer Cooperative Service
U.S. Department of Agriculture
Washington, D.C. 20250

Farmer Cooperative Service strengthens the economic position of farmers and other rural people by improving organization, development, management, and operation of their cooperatives. It works directly with cooperative leaders and Federal and State agencies on cooperative problems. It publishes research results and educational materials and issues the *News for Farmer Cooperatives*.

The Service helps (1) farmers and other rural residents get better prices for products they sell and obtain supplies and services at lower cost; (2) rural residents use cooperatives to develop and make effective use of their resources; (3) cooperatives improve their services and operate more efficiently; (4) members, directors, employees, and the public to better understand how cooperatives work and benefit their members and their communities; and (5) encourage international cooperative programs.

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Contents

Highlights

Cotton and soybean producers have been highly successful in owning and operating cooperative processing plants throughout the major cotton and soybean producing areas in the United States.

In the 1968-69 crushing season, an estimated 500,000 soybean producers marketed 92 million bushels of beans through 13 associations and 50,000 cotton producers marketed 1.1 million tons of cottonseed through 18 associations.

The net margins generated by these cooperative oil mills have raised farmer-patrons' income by substantial amounts. Returns to farmer-patrons above prevailing market prices in 1968-69 were $4.1 million for cottonseed and $3.7 million for soybeans, a combined net margin of $7.8 million.

Cooperative mills have steadily increased their percentage of total U.S. crush. Cottonseed cooperatives raised their crush from 7.7 percent of total U.S. crush in 1950 to 24.9 percent in 1968, an average increase of 1 percent a year. Soybean cooperatives' percentage rose from 3.7 percent of total U.S. crush in 1949 to 15.2 percent in 1968, an average increase of around 0.8 percent a year.

The greater volume of cottonseed and soybeans crushed by cooperatives is largely due to expansion of crushing facilities and acquisition of plants by existing cooperatives rather than to organization of new associations.

During the 12 crushing seasons, 1957-58 through 1968-69, cooperative cottonseed mills for which information was available generated net margins of $76.8 million—with $67 million or 87 percent of this paid out in cash to member patrons. Returns on members' equities (both out of pocket investments and retained earnings) averaged 25.3 percent annually for the 12-year period.

Returns to patrons of cooperative soybean mills during the 21 crushing seasons 1948-49 through 1968-69 amounted to $51 million, or 7.5 cents a bushel. Because many soybean mills are operating divisions of large regional cooperatives, their method of distribution of net margins varied.

Membership structures of cooperative oil mill associations vary by commodity and geographical area. Cottonseed associations are about equally divided between federated and combined federated-centralized organizations. The federated associations have local cooperative cotton gins as direct members and individual farmers are indirect members through their membership in local gins. The combined federated-centralized associations have both

cooperative cotton gins and individual farmers as members.

About half the soybean oil mills operate as divisions of large regional grain or farm supply cooperatives which in turn are federations of locals. One mill is part of a multipurpose cooperative which has both local elevators and producers as members.

Two soybean mills are independent federated organizations. Four mills are primarily the centralized type with individual producers as members, although a few nearby locals are members and supply beans and buy meal.

Most cooperative cottonseed and soybean mills are large-scale plants with year-round operations; several take oil beyond the crude stage. These factors allow cooperative mills to have low operating costs plus higher product revenue from sales of finished or semifinished oil and oil products.

One cooperative cottonseed oil mill developed a process for refining and winterizing oil in the miscella stage (a mixture of oil and solvent that comes from the solvent extractor). This mill also has deodorizing facilities and takes production from raw cottonseed to oil for table use in one continuous process.

Three other cooperative cottonseed mills have miscella refining facilities and market once-refined oil, a semifinished product.

Several cooperative soybean mills do further oil processing at crushing mill site. One large mill refines, bleaches, and hydrogenates the bulk of its soybean oil production and refines and hydrogenates sunflower oil produced by another of the association's plants. Another large soybean association is equipped to refine oil production from all three of its plants and has equipment at two plants to bleach, winterize, and hydrogenate. This association also packages shortening ready to be placed on grocers' shelves. Several other soybean mills produce degummed oil, a semifinished product.

Cooperative soybean and cottonseed mills have held joint annual conferences since 1955. An outstanding accomplishment of these conferences was the organization in 1962 of Soy-Cot Sales, Inc., Des Plaines, Ill. This coordinated joint sales agency markets products manufactured by 22 member mills.

Soy-Cot has been highly successful in strengthening individual mills' marketing efforts by pooling their products to give them a greater voice in the market place. Among its specific accomplishments are:

1. Brokerage expenses have been cut about one-half.

2. Soy-Cot is the seller's agent, not a brokerage agency representing both seller and buyer.

3. Soy-Cot employs a full time traffic specialist whom member mills call for advice.

4. Soy-Cot accumulates desired volume and quantity for buyers in a relatively short time.

5. Managers of member mills are able to give greater attention to mill operations since market analysis is performed by Soy-Cot.

A long term goal of Soy-Cot is to establish export markets and serve them on a direct basis.

Soy-Cot could serve as a base for forward integration by cooperative mills as a group. Several members now further process on an individual basis. Smaller mills that cannot do this economically on an individual basis might be able to operate joint facilities.

The outlook for cooperative cottonseed and soybean processing in the United States is for continuation of the movement toward large-scale, modernized plants with increasing emphasis on further processing of oil at crushing mill sites.

Cooperative mills also can be expected to move toward production of soybean and cottonseed flour for use in human food. Several already have participated in experiments and trial runs.

The need for protein for human consumption exists not only in this country but throughout the world. Cooperative cottonseed and soybean mills have both the interest and potential for fulfilling a part of this need.

Growth of Cottonseed and Soybean Processing Cooperatives

by Elmer J. Perdue and Daniel H. McVey*
Farmer Cooperative Service

Cotton and soybean farmers are increasing their income substantially through use of cooperative oilseed processing plants.

These mills are located in most major cotton and soybean producing areas of the United States. They range in size from relatively small mills serving growers in limited geographical areas to large plants that bring in volume from distant points. Some mills are single incorporated entities; others are operating divisions of large multi-purpose cooperatives.

In the 1968-69 crushing year, an estimated 500,000 soybean and 50,000 cotton growers marketed 92 million bushels of soybeans and 1.1 million tons of cottonseed through cooperative oil mills. This volume was about 15 percent of total U.S. production of beans and 25 percent of total U.S. production of cottonseed from the 1968 crop. Net margins above prevailing market prices to members were $3.7 million from soybeans and $4.1 million from cottonseed for combined total net margins of 7.8 million.

This publication gives the history of the development, growth, and trends in cooperative processing of cottonseed and soybeans in the United States. It provides guidelines to local groups considering organization of regional cooperatives represented by cooperative cottonseed and soybean associations.

Specifically the report deals with organizational structures; financing and operating policies; returns, revenues, and costs as affected by size and type of plant; other services provided membership, member and public relations; organization and operation of a central sales agency; and trends in cooperative processing.

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*Mr. McVey completed the first draft of the soybean portion of this report before his sudden death on June 12, 1970. Final revisions were made by other Farmer Cooperative Service staff members.

Development And Growth

Cooperative mills have been highly successful in the short period they have been operating. They have steadily increased their percentage of United States cottonseed and soybean crush, have been leaders in developing and adopting improved technology, and have raised farmer patrons incomes.

Cottonseed Mills

The cottonseed crushing industry was well established by the time the first cooperative mills were organized. Farmers started organizing cotton marketing cooperatives as early as 1873, but it was almost two decades before their attention turned to cottonseed.

Early Efforts

O. W. Hermann and Chastina Gardner in their 1936 account of *Early Developments in Cooperative Cotton Marketing* said: "Little reliable information is available as to the number of cooperative cottonseed-oil mills which were organized and operated in the past. A farmer cottonseed oil mill association was formed at Italy, Texas, in 1890 and operated a few years. In 1912, the United States Department of Agriculture reported that a group of farmers at Glendora, Mississippi, operated a profitable oil mill business. The same group of farmers operated a cotton business at Greenwood, Mississippi. The Farmers Union of Texas owned and operated a cottonseed oil mill at Vernon, Texas, from 1918 to 1931.

"In 1923 the Arizona Pima Cotton Growers, through a subsidiary, the Arizona Cotton Processing Company, purchased a one-fourth interest in a local cottonseed oil company which owned about 15 cotton gins and 2 oil mills. The purpose of this venture was to reduce the exorbitant ginning rates then prevailing and to obtain better prices for cottonseed. Both the parent association and its subsidiary went into receivership in 1930."

The most successful of the early cooperative cottonseed mills, Minter City (Miss.) Oil Mill, was incorporated in 1922 and is still in operation. Minter City has been a highly successful venture from the time it came into existence. An earlier publication reported that in its first 12 years of operation, Minter City was able to return to its farmer-members from $1 to $17 per ton more for their cottonseed than the average Mississippi farm price. (1 p. 42, 43, 44)[1]

[1] Underscored numbers in parentheses refer to corresponding items in Literature Cited on page 82.

1934 through 1970

Starting in 1934, cooperative cottonseed oil mills began to organize at an increasing rate. Five associations organized from 1934 through 1939; seven from 1940 through 1949, six from 1950 through 1959, and two from 1960 through 1970.

Sixteen of the 20 cooperative cottonseed mills organized in 1934 through 1964 were active in 1970.[2] During this period most of the cooperatives expanded and modernized facilities and some acquired additional plants at other locations (table 1).

Several circumstances contributed to the rise in number of mills after 1933. Cotton farmers had gained experience in cooperation from their earlier cotton marketing and ginning organizations. Most cotton States had by then passed laws specifically designed for organization of cooperatives. And growers in new cotton areas were organizing cooperative gins which became bases for large federated regional mills.

Finally, one of the most important factors was creation of the Federal Farm Credit System in 1933. Oil mills have relatively high investments in machinery and equipment and Banks for Cooperatives—part of the Farm Credit System—became the source for borrowed capital.

The growth in number of cooperative mill associations after 1933 is largely attributed to their success in increasing cotton farmers' income.

One of the earliest publications on cooperative cottonseed oil mills showed that three mills in 1935-36 returned to members an average of $4.74 a ton above open market prices. This was after deductions of 6 percent interest on total invested capital, whether borrowed or furnished by members, together with interest on all borrowed operating capital. Similar savings in 1936-37 were $9.75 a ton and $6 a ton in 1937-38 (2 p. 4).

A later publication showed savings to be $3.25 a ton in 1957-58; $5.46 in 1958-59, and $7.24 in 1959-60 (3 p. 4).

Volume of Cottonseed Processed

Volume of seed processed is a significant measure of the growth of cooperative mills. In 1950 cooperative cottonseed mills crushed 7.7 percent of the total U.S. crush. For the 1968 crop year, the proportion had increased to 24.9 percent (table 2). Average annual increase in percentage of total U.S. crush was around 1 percent.

The number of cooperatives rose slightly but the increased volume was mostly from expansion of

[2] Associations which ceased operations were at Midlothian and Hamlin, Tex.; Chandler, and Safford, Ariz.

Table 1.—Cooperative cottonseed processing associations active in 1970

Association	*Plant location*[1]	*Year organized plant built or acquired*	*Other oilseeds processed*
Minter City Oil Mill	Minter City, Miss.	1922	
Farmers Cooperative Oil Mill	1. El Paso, Tex.	1934	
	2. Pecos, Tex.	1968	
Tornillo Cotton Oil Mill	Tornillo, Tex.	1934	
Plains Cooperative Oil Mill, Inc.	1. Lubbock, Tex.	1937	soybeans
	2. Plainview, Tex.	1964	castor beans
Delta Products Co.	Wilson, Ark.	1937	
Ne-Tex Cooperative Oil Mill	Wolfe City, Tex.	1939	soybeans
Helena Cotton Oil Co.	Helena, Ark.	1942	
Cen-Tex Cotton Oil Mill	Thorndale, Tex.	1943	
Delta Oil Mill, Inc.	Jonestown, Miss.	1943	soybeans
Producers Cooperative Oil Mill	Oklahoma City, Okla.	1944	soybeans
Osceola Products Co.	Osceola, Ark.	1945	
Ranchers Cotton Oil	1. Fresno, Calif.	1950	safflower
	2. Bakersfield, Calif.	1964	safflower
Valley Co-op Oil Mill	Harlingen, Tex.	1950	
Yazoo Valley Oil Mill, Inc.	Greenwood, Miss.	1956	soybeans
Luna Cotton Cooperative Assn.	Deming, N.M.	1957	
Pecos Valley Cotton Oil, Inc.	1. Loving, N.M.	1960	
	2. Roswell, N.M.	1960	
Forrest City Cotton Oil Mill, Inc.	Forrest City, Ark.	1964	

[1] Where two or more plant locations are given, headquarters of association is first site listed.

Table 2.—Tons of cottonseed crushed and percent of U.S. total crushed by cooperative cottonseed oil mills, crop years 1950 through 1968

Crop year	*Cooperative mills*	*Cottonseed crushed by cooperatives*	*Total U.S. crush*[1]	*Percentage crushed by cooperatives*
	Number	*1,000 tons*	*1,000 tons*	*Percent*
1950	13	270	3,502	7.7
1951	14	422	5,546	7.6
1952	13	435	5,581	7.8
1953	13	500	6,330	7.9
1954	13	550	5,229	10.5
1955	13	564	5,556	10.2
1956	16	608	4,980	12.2
1957	16	578	4,274	13.5
1958	17	691	4,382	15.8
1959	14	874	5,505	15.9
1960	14	919	5,402	17.0
1961	15	1,016	5,622	18.1
1962	15	1,113	5,803	19.2
1963	16	1,193	5,851	20.4
1964	18	1,239	5,929	20.9
1965	19	1,272	5,836	21.8
1966	19	988	3,743	26.4
1967	17	818	3,017	27.1
1968	18	1,100	[2]4,425	24.9

[1] Source: Agricultural Statistics, U.S. Dept. of Agriculture.
[2] Preliminary.

crushing facilities. Crushing capacity at one mill which is operated in conjunction with gins at the same location is only 35 tons a day. The other cooperative mills, however, range in capacity from 125 tons to 1,200 tons a day.

On the average, crushing capacity and length of operating season at cooperative mills are considerably greater than the average for the cottonseed industry.

Plant Modernization

Cooperative cottonseed mills are technological pace setters. They were among the first in the industry to install modern screw press and solvent extraction facilities.

The Delta Products Company, a farmer cooperative at Wilson, Ark., was the first cottonseed oil mill in the United States to use the solvent process—starting this

in March 1947. The following year cooperative mills at Helena and Osceola, Ark., also installed solvent plants. Later Delta Products Company added screw presses to become the first prepress solvent extraction plant for cottonseed in the United States. (4 p. 27).

In the early 1950's, Ranchers Cotton Oil, Fresno, Calif., developed and patented a process for miscella refining and winterizing of cottonseed oil. Miscella is the technical term for the mixture of crude oil and hexane that comes from solvent extraction units. Miscella refining (refining while oil is in presence of solvent) gives greater efficiency and higher quality oil than off-mill-site refining since color pigments in the oil do not have time to set.

This mill also has on-mill-site deodorizing facilities where raw cottonseed becomes finished oil ready for the table in a continuous process. It is the only cottonseed mill in the United States that can do this.

Economic Benefits

The continuing growth of cooperative mills is based on economic benefits to member-patrons. During the 12 crushing seasons, 1957-58 through 1968-69, cooperative cottonseed mills for which information was available generated net margins of $76.8 million (table 3).

Net margins varied considerably between seasons and ranged from a low of $2.7 million in 1957-58 to a high of $12.3 million in

Main office at Ranchers Cotton Oil, Fresno, Calif. symbolizes the progressive character of the cooperative. This is the only mill in the United States that processes cottonseed into salad oil ready for table use in one continuous process.

Table 3.—Net margins and return on members' equity, cooperative cottonseed oil mills, crushing seasons 1957-58 through 1968-69

Crushing season	*Mills*[1]	*Total net margin*[2]	*Total members' equity*[3]	*Return on members' equity*
	Number	*$1,000*	*$1,000*	*Percent*
1957-58	14	2,676	18,637	14.4
1958-59	15	4,979	18,877	26.4
1959-60	15	8,343	20,282	41.1
1960-61	15	6,787	22,876	29.7
1961-62	15	7,732	24,830	31.1
1962-63	15	7,941	27,137	29.3
1963-64	14	4,663	28,361	16.4
1964-65	13	8,633	28,685	30.1
1965-66	12	12,258	29,725	41.2
1966-67	13	4,503	31,887	14.1
1967-68	10	4,146	29,302	14.1
1968-69	9	4,149	28,511	14.6
Total	—	76,810	—	—
Average	—	6,401	—	25.2

[1] Financial data not available for all mills.

[2] Cooperatives advance open market price for seed except in two cases. At one mill, open market prices are kept by a public agency and given in the mill's audit report. In the other, net margins were based on average farm price for the State, less $7.50 a ton allowed for gin margin on seed.

[3] Includes both out-of-pocket investments and retained earnings.

1965-66. The average was $6.4 million.

Although return on investment is not a cooperative's primary objective, it is a good measure of the cooperative's success as a business enterprise. This assumes that net margins are returns over and above open market prices, which is the case in this report.

Returns on members' equity (both out of pocket investments and retained margins) have been very high for cooperative cottonseed mills. As shown in table 3, members averaged 25.2 percent return on their equity over the 12-year period. The lowest return was 14.1 percent in 1966-67 and 1967-68; the highest was 41.2 percent in 1965-66.

Another important benefit is that most of the net margins have been paid out to members in cash. During the 12-year period, members' equity increased from $18.6 million to $28.5 million, an increase of only $9.9 million as compared to the $76.8 million net margins generated during this period (table 3). Assuming that increase in members' equity came

from retained earnings, the cooperatives paid out $66.9 million or 87 percent of their net margins to members.[3]

Soybean Mills

The first statistics on soybean production were reported by the U.S. Department of Agriculture for the 1924 crop year. Much of the soybean production in the 1920's was for hay. For example, in 1924 only 415,000 acres of soybeans were grown for beans while 1 million acres were for hay and other purposes. Production of beans in 1924 was less than 5 million bushels.

Even in 1930, about 70 percent of the acreage was for hay. That year bean production amounted to almost 14 million bushels and a little over 4 million bushels were processed. Production gradually increased and amounted to 77.5 million bushels in 1940 of which 64 million bushels were crushed. So it was in the 1930's that the soybean crushing industry began to be established.

Cooperative Activity

Producers in western Kentucky and eastern Indiana built the first cooperative soybean plant at Henderson, Ky., in 1940-41. This was an effort to increase bean prices, to encourage production by offering another market, and to have a source of high protein feed for livestock.

During and immediately following World War II, it became almost impossible for soybean producers to obtain soybean meal either as meal or in the form of mixed feeds. To alleviate this situation, they built cooperative mills. Farmers also believed that if concerns other than cooperatives could operate soybean oil mills profitably, they should be able to do likewise, particularly since growers through their large number of cooperative elevators controlled a substantial proportion of beans produced.

Between 1940 and 1949, soybean producers constructed 21 soybean mills—19 of them from 1940 to 1945. These plants were in Pennsylvania, Ohio, Indiana, Illinois, Iowa, Wisconsin, Kansas, and Missouri.

During the period 1950 to 1970, eight cooperatives constructed or acquired 10 mills. These were in Minnesota, Missouri, Arkansas, and Georgia in areas where bean production has been increasing rapidly.

Thus between 1940 and 1970, 29 cooperatives built or acquired 31 processing plants.

In 1970, 13 of these cooperatives were still in operation with

[3] Data were not available for some cooperative cottonseed mills during latter years or the increase in members' equity would have been greater than shown. However, net margins also would have been greater and percentage of net margins paid out to members would be about the same.

15 crushing plants (table 4). Sixteen plants have ceased operations (table 5).

All the early plants were small and were built for the primary purpose of serving as a source of high protein feed. Most of them had a capacity of only 10 to 50 tons a day.

By the early 1950's, larger plants had been constructed and protein was more readily available through commercial channels. As the situation became more competitive, the small plants (many of them poorly located) found they could not produce and sell meal at competitive prices without operating at a loss. By the mid-1950's many of them had closed and by 1960 most had ceased operation.

Only three screw press plants

Table 4.—Cooperative soybean processing associations operating in 1970

Association[1]	*Plant location*	*Year plant built, or acquired*
Farmers Grain Dealers Association, Des Moines, Iowa, Soybean Division	Mason City, Iowa	[2]1943
Boone Valley Cooperative Processing Association	Eagle Grove, Iowa	1943
Farmers Regional Cooperative, Fort Dodge, Iowa, Big 4 Division	Sheldon, Iowa	[3]1943
West Bend Elevator Company	West Bend, Iowa	1943
Farmers Cooperative Association	Ralston, Iowa	1944
Missouri Farmers Association, Columbia, Mo., Soybean Division	Mexico, Mo.	1946
Producers Cooperative Association	Girard, Kans.	1948
Dawson Mills	Dawson, Minn.	1951
Arkansas Grain Corporation, Stuttgart, Ark.	Stuttgart, Ark.	1958
	Helena, Ark.	1965
	Stuttgart, Ark.	1968
Farmland Industries, Kansas City, Mo. Soybean Processing Division	Van Buren, Ark.	[4]1960
Farmers Union Grain Terminal Association, St. Paul, Minn., Honeymead Products Division	Mankato, Minn.	1960
Far-Mar-Co, Inc., Hutchinson, Kans.	St. Joseph, Mo.	1963
Gold Kist, Inc., Atlanta, Ga. Gold Kist Soy Division	Valdosta, Ga.	1968

[1] Headquarters listed if different from plant location.

[2] Located at Manly, Iowa, 1943-1951; moved to Mason City in 1951; merged in 1967 with Farmers Grain Dealers Association.

[3] Big 4 Cooperative Processing Assocation merged with Farmers Regional in 1967. In 1970, Farmers Regional merged with Land O'Lakes.

[4] Co-op Processing Association acquired by Farmland Industries in 1968.

Table 5.—Cooperative soybean processing plants that had ceased operations as of 1970

Association[1]	*Plant location*	*Year plant built, or acquired*
Ohio Valley Soybean Cooperative	Henderson, Ky.	1940
Coshocton Farmers Exchange	Coshocton, Ohio	1943
Ohio Farm Bureau Cooperative Association, Columbus, Ohio	Springfield, Ohio	1943
Farmers Cooperative Elevator	Martelle, Iowa	1943
Farmers Cooperative Company	Dike, Ohio	1943
Indiana Farm Bureau Cooperative Assn., Indianapolis, Ind.	Danville, Ind.	1943
	Wabash, Ind.	1944
	Vincennes, Ind.	1944
	Rushville, Ind.	1945
Alhambra Grain and Feed Company	Alhambra, Ill.	1944
Consumers Cooperative Association, Kansas City, Mo.	Coffeyville, Kans.	1945
Jersey Shore Cooperative Soybean Association	Jersey Shore, Pa.	1945
Northwest Co-op Mills, St. Paul, Minn.	Menominie, Wis.	1945
Farmers Cooperative Elevator	Hubbard, Iowa	1945
Farmers Cooperative Elevator Association	Blooming Prairie, Minn.	1950
Halstad Elevator Company	Halstad, Minn.	1956

[1] Headquarters listed if different from plant location.

were operating in 1970; each one processing only 40 to 50 tons a day. The other 12 plants were large solvent plants ranging in capacity from 250 to 1,700 tons a day. Most of the recently constructed plants have a daily capacity of about 1,500 tons.

Consideration of the location of present plants compared with the plants that no longer exist shows that eight of those closed were in Ohio, Indiana, and Illinois where there are no cooperative plants today. Yet more than 35 percent of the beans produced in the United States in 1969 were grown in these three States. Cooperative expansion has been in Minnesota, Iowa, Missouri, Arkansas, and Georgia.

Volume of Soybeans Processed

Although the number of cooperative processing plants has declined, the volume of beans processed has increased substantially.

Until the 1959 crop, cooperatives had never crushed as much as 4 percent of the beans processed

in the United States. Since then, the proportion has increased to a little over 15 percent for the 1968 crop (table 6).

This increased crush by cooperatives has resulted from expansion or acquisition of existing plants and from construction of new plants.

Plant Modernization

Only two of the early plants were solvent plants; the others were screw press. One of the solvent plants, a 10-ton-a-day plant was at Danville, Ind., and the other at 25-ton-a-day plant at Springfield, Ohio. Solvent plants have replaced screw press at Mason City, Eagle Grove, and Sheldon, Iowa; and at Mexico, Mo.

All three plants of Arkansas Grain Corporation have on-site refining equipment and are producing salad and cooking oil. Winterizing, deodorizing, and hydrogenation equipment have been added at the two Stuttgart plants. A packaging plant has also been added at Stuttgart. Thus, raw soybeans start at the front of the plant and through a continuous process, a finished, packaged product comes out at the other end of the plant ready to go on the grocery shelf. This cooperative also operates an oil canning plant in New Orleans.

Honeymead Products, Division

Table 6.—Soybeans crushed and percent of U.S. total crushed by cooperative mills, selected years, 1949-68

Crop year	*Cooperatives*	*Soybeans crushed by cooperatives*	*Total U.S. crush*[1]	*Percentage crushed by cooperatives*
	Number	*1,000 bushels*		*Percent*
1949	19	7,378	195,265	3.8
1954	12	8,012	249,010	3.2
1959	13	20,584	394,000	5.2
1960	11	33,517	406,100	8.3
1961	11	46,934	431,400	10.9
1962	12	44,764	472,800	9.5
1963	12	50,823	436,800	11.6
1964	12	62,559	479,000	13.1
1965	11	76,959	537,500	14.3
1966	12	76,500	559,400	13.7
1967	12	79,176	576,400	13.7
1968	13	92,130	605,900	15.2

[1] Source: Agricultural Statistics, U.S. Department of Agriculture.

Soybean processing plant at Valdosta, Ga., of Gold Kist Inc. (formerly Cotton Producers Association). This plant has a daily capacity of 1,500 tons. Much of the meal produced here goes into the association's integrated feed and poultry operations.

of Farmers Union Grain Terminal Association, Minneapolis, Minn., likewise has complete refining and hydrogenation equipment at Mankato, Minn. It also produces soy flour and grits for industrial purposes.

MFA Soybean Mill at Mexico, Mo.; Far-Mar-Co, Inc., St. Joseph, Mo.; and Goldkist Soy Division of Valdosta, Ga., of Goldkist, Inc. (formerly Cotton Producers Association), Atlanta, Ga., have equipment for degumming oil, the first step in refining.

All but one of the solvent plants are equipped to produce 50 percent as well as 44 percent protein meal.

Economic Benefits

Members of cooperative soybean associations receive substantial economic benefits. During the 21 crushing seasons, 1948-49 through 1968-69, nearly 680 million bushels of beans were crushed and net margins amounted to $50.6 million or 7.5 cents a bushel. This takes into account the 4 years when the mills as a group lost money (table 7).

The highest net margin was in 1965-66, nearly $14 million. Net margins for the four seasons 1965-66 through 1968-69 amounted to $30.7 million, or more than 60 percent of the 21-year total.

Table 7.—Net margins, cooperative soybean processors, crushing seasons 1948-49 through 1968-69

Crushing season	Mills	Bushels crushed	Net margin	
			Total	Per bushel
	Number	1,000	1,000 dollars	dollars
1948-49	19	6,699	1,206	.18
1949-50	19	7,378	295	.04
1950-51	20	8,129	1,057	.13
1951-52	17	6,849	- 274	- .04
1952-53	12	5,021	- 351	- .07
1953-54	12	7,713	309	.04
1954-55	12	8,012	- 80	- .01
1955-56	12	9,638	675	.07
1956-57	10	10,061	905	.09
1957-58	12	11,716	1,406	.12
1958-59	13	13,972	1,677	.12
1959-60	13	20,584	618	.03
1960-61	11	33,517	2,011	.06
1961-62	11	46,934	2,347	.05
1962-63	12	44,764	6,715	.15
1963-64	12	50,823	2,033	.04
1964-65	12	62,557	- 626	- .01
1965-66	11	76,959	13,853	.18
1966-67	12	76,500	8,415	.11
1967-68	12	79,176	4,751	.06
1968-69	13	92,130	3,685	.04
Total	—	679,132	50,627	.075

Organizational Structure

Cooperatives are legal entities operating under State laws and in accordance with legal documents adopted by their memberships. These laws and documents provide basic operating policies and deal with such areas as the purpose of the cooperative, membership and director qualifications, voting and control, election and duties of officers, and capital structure.

Service, commodity, and area conditions influence the organizational structures of cooperatives. Thus considerable variation exists.

Corporate Status

Cooperative oil mills can be organized under either the State's cooperative laws or general corporation laws. They also can be organized as separate corporate entities or can be owned and operated as a part of a multipurpose cooperative.

State Cooperative Laws

All except two of the cooperative cottonseed mills are organized and operated under their State's cooperative laws.

Only three of the currently operating cooperative soybean processing associations were organized for that sole purpose. Three others that were so organized have merged with regional cooperatives. Five others were built by existing local or regional cooperatives and two were existing noncooperative plants acquired by regional cooperatives.

All these organizations operate within the State cooperative laws under which they were organized or within the framework of parent organizations organized under cooperative law.

State cooperative laws vary, but in general, contain provisions designed to perpetuate their cooperative character.

Some of the more important provisions pertain to membership qualifications and distribution of net savings. Membership is limited to agricultural producers; voting is usually restricted to one vote per member irrespective of the amount of stock owned or capital invested. Dividends on capital may not exceed 8 percent a year and distribution of net margins on a patronage basis is required.

Operating Organization

All but two cooperative cottonseed mill associations are separate corporate entities with oilseed processing their primary function. One association has combined ginning and oil mill functions and one has co-equal cotton marketing and oil mill departments.

Practically all the early cooperative soybean mills were constructed by local cooperative elevators and became operating divisions of the locals. The three small screw press plants still operating at Ralston and West Bend, Iowa, and Girard, Kans., are in this category. In addition to their elevators and soybean plants, these organizations operate feed mills and handle farm supplies. Soybean processing is not a major part of their operation.

As shown in table 4, seven of the cooperative soybean processing plants are now operated as divisions of large regional grain or farm supply cooperatives.

The soybean plants at Eagle Grove, Iowa, and Dawson, Minn.

are owned by local cooperative elevators in the territory in which they operate. These are federated cooperatives.

The three mills of Arkansas Grain Corporation are owned directly by producers who also own the local cooperative elevators that receive, handle, and store beans for the processing plants.

Organization Alternatives

Whether a cooperative oil mill is organized as a separate corporate entity or as a department of a multipurpose cooperative depends largely upon alternatives available at the time the mill is organized or acquired.

Oil mills are large-scale businesses and require resources for accumulating beans or seed. Regional grain cooperatives, through local grain elevators, have an existing base for this. Soybean oil mills can be efficiently integrated into grain operations as indicated by the trend among grain regionals to build or acquire soybean plants. Similarly, regional supply cooperatives that use large quantities of soybean meal in mixed feed operations can gain economic advantages from operating soybean mills.

Most cooperative cottonseed mills are separate corporate entities because they had no alternatives at the time they were organized. Some areas did have regional cotton marketing cooperatives but oil milling is not as complementary to cotton marketing as

Aerial view of Farmers Cooperative Oil Mill, El Paso, Tex. Note open stacks of cottonseed. These save investment costs of seed houses.

soybean milling is to grain marketing and feed processing. In some areas the oil mill was the first regional cotton cooperative to be organized.

Under the present ginning system where gins operate only a few weeks during the year, the advantages of a multipurpose cotton cooperative would be limited. However, recent research shows advantages of assembling and storing large lots of seed cotton to be ginned over longer seasons at centrally located gins. This ginning system would open the way for consideration of multipurpose regional cooperatives that would assemble and gin seed cotton, compress and market lint cotton, and process cottonseed at one location.[4]

Membership Structure

Existing cooperative oil mills have three types of membership structure (figure 1).

In the centralized type, individual growers are direct members of the mill or of the multipurpose cooperative which owns the mill. In the federated type, individual growers are members of local cooperative cotton gins or grain elevators which in turn are members of the mill or multipurpose cooperative. The combination centralized-federated type has both individual growers and local cooperatives as direct members of the mill or multipurpose cooperative.

Cottonseed Mills

All three types of membership are found in cooperative cottonseed mills. Seven mills are federated associations with membership ranging from 9 to 104 gins. Nine are centralized-federated and one is centralized. The centralized association is a combined ginning and milling association serving farmers in a geographically limited cotton producing area.

A federated cottonseed cooperative has several advantages. Cooperative gins can assemble and keep records on small lots of cottonseed more economically than the oil mill can. Also cooperative gin managers and directors have closer personal contact with growers and can keep them informed on oil mill operations.

The centralized-federated associations are in areas where production of individual growers is relatively large. Several large growers own and operate gin plants for their own production giving this type mill many of the advantages of a federation.

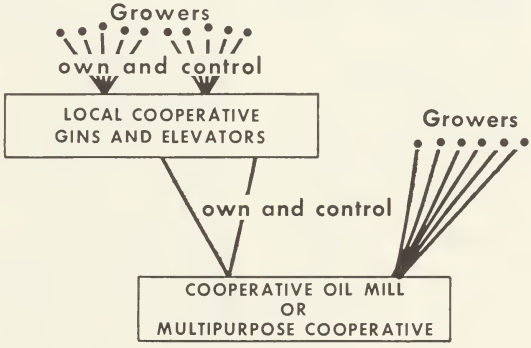
[4] For more information see: Campbell, John D., Central Cotton Ginning Comparative Costs, Use in Other Countries, and Potential Use in the United States. Farmer Cooperative Service, U.S. Dept. of Agr. FCS Research Report 4. Jan. 1969.

FIGURE 1.--OWNERSHIP AND CONTROL OF COOPERATIVE COTTONSEED AND SOYBEAN OIL MILLS

I CENTRALIZED CONTROL

II FEDERATED CONTROL

III COMBINATION CENTRALIZED AND FEDERATED CONTROL



Soybean Mills

Six of the seven cooperative soybean mills that operate as divisions of regional grain or farm supply cooperatives are federations of locals. These mills receive beans only from the locals. The number of locals varies from 100 to 700.

Another of the mills operating as part of a multipurpose cooperative has both local elevators and producers as members. It serves thousands of producers.

Two mills are independent federated organizations with memberships of 100 to 150 local cooperatives.

The other four mills are primarily the centralized type with individual producers as members, although a few nearby locals are members and supply beans and buy meal. These associations have from about 1,000 to well over 25,000 producer-members.

Financial Structure

Organizational documents of a cooperative should provide for a financial structure based on sound cooperative principles. Members should provide enough captial so that necessary borrowing can be on a sound basis. Equity of individual members should be kept as closely as possible in proportion to their use of the cooperative. And voting stock or other membership evidences should be kept in the hands of active patrons.

Considerable variation exists in financial structures of cooperative oil mills. Some have capital stock, some are on a nonstock basis, and others have features of both plans. Some mills declare dividends on capital stock; other do not. Evidences of members' financial interest range from issuance of stock certificates to allocated book credits.

Cottonseed Mills

Twelve cooperative cottonseed mills have capital stock and four are on a nonstock basis. Eleven of the 12 mills with capital stock have common (voting) stock with par value ranging from $5 to $100. The other mill with a capital stock plan does not have common stock and voting is based on meeting membership requirements.

Membership fees at two nonstock mills are $10 and $5. The other two nonstock mills have no membership fees.

Cooperative cottonseed mills keep financial investment of members in proportion to their use of the cooperative through revolving funds. Revolving fund financing at all but one mill is based on retention of a portion of current net margins and paying out retained capital of prior years.[5] The period

[5] At one cottonseed mill the revolving fund is made up of capital retains deducted from initial advance paid for seed.

between the time capital is retained and paid out varies among mills but averages about 5 years.

Payment of dividends on equity captial varies from no dividends at most mills to 8 percent on a small number of shares of preferred stock at one mill.

Voting stock or membership rights are terminated when members cease to be active. The period between inactivity of a member and his removal from membership rolls is usually 1 year but at one mill can be as long as 5 years under a 5-year marketing agreement contract.

Soybean Mills

Four cooperative soybean mills have a membership fee as a basis for voting; the fee ranges from $1 to $25. Nine mills have capital stock with common stock carrying the voting privilege.

The par value of common stock varies from $1 for individual producers to $10,000 for local elevators. Eight organizations also have perferred stock with par value from $1 to $100 that carries no voting rights.

Revolving fund financing is used by these mills so that current users will help finance operations. The retirement period varies from 1 to several years and frequently is in the 7 to 8 year range.

Dividend payments are mostly limited to preferred stock at a rate of 4 to 6 percent. Four mills pay from 1 to 5 percent on common stock.

Marketing Agreements

To be successful, a marketing cooperative needs assurance that members will deliver adequate volumes of commodity. Marketing agreements are one way of accomplishing this.

Cottonseed Mills

In 1968, seven cooperative cottonseed mills had marketing contracts with members; four mills had had such agreements during earlier years; and four had never had marketing contracts.

Cottonseed mill managers' attitudes toward marketing agreements ranged from "a must for cooperatives" to "no advantages." In general, managers were of the opinion that marketing contracts are effective to some extent, especially during the early years of a cooperative's operations. Several managers of mills without marketing agreements stated that agreements were desirable but would not be acceptable to their members.

Soybean Mills

Only two soybean cooperatives operate with marketing agreements. These agreements have been in effect since they were

organized. None of the other associations have ever used such agreements.

Some of the cooperatives have considered attempting to institute such a system. They realize the value of marketing agreements but believe it will take much educational work to get membership approval.

Boards of Directors

A cooperative is managed by an elected board of directors which in turn hires a manager to carry on the everyday business activities of the association.

Although some policies are set forth in bylaws, directors make important decisions that affect the success of the association. Members should recognize the importance of qualified directors and select the most capable of their number.

Cottonseed Mills

Election of directors takes place during the oil mills annual meeting in all cases. Methods of selection of nominees vary, however.

At all mills where farmer members and gins are concentrated within a radius of 25 to 30 miles, nomination of directors take place at the mills' annual meetings.

Where member gins and producers cover a wide geographic area nomination of directors usually takes place at the gin level. Exceptions include two federations and one centralized-federated mill. These three mills select nominees at their annual meetings.

Nomination and election of directors of cooperative cottonseed mills are kept in the hands of producers, either directly at the annual meetings of the oil mills or at the local gin level.

Qualifications—Qualifications for directors of cooperative cottonseed oil mills vary because of type of membership and other factors. In general, directors of mills are agricultural producers. However, managers of member-locals can serve on the boards of some federated cooperatives; in other federations, managers of locals are not eligible. Even where managers of locals can serve as directors, their number is small compared to producers.

Some federations have an additional qualification that their directors must also be on the board of a local cooperative.

There is a difference of opinion regarding managers of locals serving on the board of a federation. One opinion is that directors of a federation should have a direct interest as agricultural producers; the other is that managers of locals are the most knowledgeable on operations of the federation and can keep members informed. A board made up of both agricultural producers and managers of

locals is a compromise that has worked satisfactorily.

Size of Board—The number of directors on boards of cooperative cottonseed mills ranges from 7 to over 100. In 1969 the average was about 50 members. In general, the larger the production area, the larger the board of directors.

Five of the seven federated mills have a director from each member gin. The other two have seven directors each, chosen on a regional basis. One of these mills also has an advisory board with a director from each gin. This group meets three times a year.

Some people object to a large board because they believe it is too cumbersome to transact business efficiently. However, cooperatives that have large boards do not agree. In most cases they use committees to study specific proposals for later consideration by the entire board.

Mills having experience with both large and small boards also indicate the advantages of having a director from each member gin far outweigh disadvantages that might be inherent in a large board. By having a director from each gin, each community has a direct voice in the federation and is kept currently informed of its operations.

Compensation—Cooperative cottonseed mills in general pay directors a mileage rate and per diem for attendance at board meetings. Usually the amount of compensation is set at a level to cover travel expenses.

At most mills officers receive compensation in addition to their travel expenses.

Soybean Mills

In centralized soybean mills, boards of directors are made up of producer-stockholders or members. The number varies from 5 to 30. All directors are elected for 3-year terms on a staggered basis. This assures having some experienced members on the board at all times.

In all but one federated and multipurpose cooperative two-thirds of the board members must be producers and members of local cooperatives that are members of the regional. The remainder are managers of local cooperative-members; often they are also producers.

Thus, in all cases, farmer control of cooperative soybean mills is assured.

In the federated and multipurpose cooperatives, directors are elected by districts which are usually based on the volume of beans or grain received. They serve 3-year terms with one-third being elected each year to assure continuity and smooth operation. The number of directors ranges from 7 to 32. Of course, in multi-purpose cooperatives with soybean processing divisions, the board must direct all the other activities as well as soybean processing.

The smaller boards usually meet monthly. Some of the larger

boards meet monthly; others, quarterly. They usually have an executive committee which meets as necessary.

Per diem compensation for directors covers expenses and cost of transportation or mileage at 10 cents a mile or less.

Financing And Operating Policies

Cooperative cottonseed and soybean oil mills are established manufacturing businesses whose objective is to maximize net sales returns from seed and beans delivered by patron members. Physical plant operations are practically the same as those of other mills. However, important differences in financing and some operating policies arise from the relationship between a cooperative and its member-owners.

Financing

A cooperative mill must have adequate and sound financing to succeed. Funds must be available to make initial advances to patrons for seed or beans and to meet current operating expenses. If the cooperative is to grow, captial must be expanded from time to time for plant expansion and modernization.

Cooperative oil mills draw heavily upon district Banks for Cooperatives for both short-term and long-term financial needs. Loans are obtained to make advances on seed and beans and then are repaid during the season as products are manufactured and marketed.

Longer term loans for facilities are repaid from revolving fund capital built up from retained earnings. Also several cooperatives have raised long-term capital by sale of stock, debentures, and certificates of indebtedness.

All the cooperative cottonseed and soybean oil mills use revolving fund capital. Under a revolving plan of financing, patrons make capital contributions in proportion to their use of the cooperative either by capital retains from initial advances, from earnings, or both. As a revolving fund builds up by continuous capital contributions from current patrons, capital contributions from earlier years are repaid to those who supplied them.

Price Advance Policies

Patrons of cooperative mills, in effect, do not market cottonseed and soybeans as such but rather market the manufactured products processed from these commodities.

Net sales returns to patrons are gross sales receipts from products less all transportation, manufacturing, administrative, and financing costs. Net sales returns therefore include initial advances; progress payments, if any; and final settlements.

Initial payments that patrons receive for seed and beans are advances toward final net sales returns which cannot be determined until the end of the crushing year and after the audit is completed. Price advance policies vary considerably between and within commodity groups.

Cottonseed

All but three of the cooperative cottonseed mills advance the full open market prices in their respective areas. Two mills base their initial cash advance on open market prices but pay slightly under full market price to reduce risk to the cooperative.

The other mill operates a seasonal pool, advancing approximately 80 percent of the anticipated net sales returns for the season less a capital retain. The final net pool settlement at the end of the year is in cash since capital retains from the initial advance are sufficient for capital purposes. The initial advance is the same throughout the seed receiving period and adjustments for grade differences are made in the final settlement.

The board of directors of a cooperative cottonseed mill must consider several factors in setting initial advance policies. A primary consideration is to minimize risks of operating losses which not only impair members' equity but also lower members' confidence.

Cottonseed is a semiperishable commodity that moves into storage at the oil mill in a short period of time, usually the same day the cotton is ginned. The bulk of a season's crush is received and bought within a 2 to 3-month period.

Cottonseed product prices fluctuate considerably during the year and mills can protect themselves from declining product prices only to a limited extent. There are no organized future markets for cottonseed oil, linters, and hulls. Refined cottonseed oil can be bought and sold on the organized futures markets at New York and Chicago, and meal at Memphis. However, most cooperative cottonseed mills do not directly use these organized futures markets for either oil or meal.

Price protection usually is limited to forward sales of oil at specified price for delivery in the near future. To a lesser degree, meal also is sold forward.

The primary advantage claimed for advancing full open market prices is that patrons can measure the efficiency of their cooperatives by net margins. This policy has worked satisfactorily in most

instances. However, in some cases open market prices are excessively high when based on competitive bidding for short supplies of seed and cooperatives as well as other cottonseed mills have had operating losses.

The cooperative mill which has a season pool policy adheres to all cooperative principles. The practice of advancing 80 percent of anticipated net sales returns minimizes chances for operating losses. Also, the initial advance is sufficient to meet member gins' operating and working capital requirements until such time as final payment is known and paid.

Soybeans

All the cooperative mills buy beans at the going market price for their area. They have a delivered price for truck and rail at the mill and track and truck prices at each of the local member elevator.

In some cases they buy beans from their members for future delivery and pay the members storage and handling charges until the beans are shipped.

In contrast to cottonseed, soybeans, with reasonable care, can be stored and their quality maintained for a long period. Although there is usually quite a movement to mills during the harvest season, local elevators and producers store a major portion of the crop and market beans throughout the year, particularly in the Midwest.

The situation is somewhat different in the South and Southeast. There inadequate storage facilities and the pull of the export market combine to make it almost imperative for processing plants to buy their expected crush at harvest or in a period of 6 to 8 weeks.

In contrast to cottonseed and cottonseed products, very active futures markets exist for soybeans and soybean products. Processors and others use them to keep price fluctuations at a minimum.

Soybean processing cooperatives use the futures market extensively for hedging beans and products. Most of them are members of Illinois Cooperative Futures Company which is owned by grain cooperatives. It has a seat on the Chicago Board of Trade and places hedges for its members at a substantial saving in cost.

Soybean mills also protect themselves by forward selling of products. Practically all the soybean meal goes to mixed-feed manufacturers and it is not unusual for them to buy their meal requirements several months or a year in advance. Refineries also buy oil for future delivery to be assured of an adequate steady supply at all times.

Two associations also operate on a seasonal pool basis, advancing something less than the market and support price at the time beans are delivered. As the beans are crushed and products are sold, additional advances are made. At

the end of the year, when all expenses are known and capital retain requirements are determined, a final payment is made.

These two associations operate with a membership agreement or contract which gives the cooperative authority to move and process the beans and sell the products while the producer retains a beneficial interest in the beans until final settlement.

Distribution of Net Margins

Most cooperative mills advance open market prices on cottonseed and soybeans and therefore have net margins to distribute at the end of the year. The most common forms of distribution are cash on current patronage, revolving fund retains, dividends on members' equity capital, and reserves.

Cottonseed Mills

Aggregate net margins for cooperative cottonseed mills during the 12-year period 1957-58 through 1968-69 were distributed as follows: 6 percent to dividends on members' equity, 39.9 percent cash on current patronage, 53.6 percent revolving fund, and 0.5 percent contingency or unallocated reserves (table 8).

The greatest variation between years was in the percentage of net margins going to dividends on members' equity. The amount paid out as dividends remained about the same from year to year until 1967-68, with variation caused mostly by size of net margins. It appears that cooperative cottonseed mills during this 12-year period attempted to keep distribution level around one-half cash including dividends, and one-half revolving fund.

Soybean Mills

As indicated earlier, most soybean mills have been constructed by, acquired by, or merged with regional grain or farm supply cooperatives.

Some mills divide net margins between producers of beans and buyers of meal. Three of the Iowa federated mills (before two of them merged with regionals) divided net margins about equally between bean patrons and meal purchasers. The other Iowa mill still follows this practice.

The two associations operating on a pool basis have no net margins to distribute since they pay all sales proceeds, less expenses and capital retains, in cash.

Some organizations, in addition to paying 20 percent of net margins in cash as required by law, have adopted a policy of retiring all equities of deceased members and of those who have quit farming or have reached certain specified ages.

One cooperative, with more than 100 locals as members, had

Table 8.—Percentage distribution of net margins, cooperative cottonseed oil mills, crushing seasons 1957-58 through 1968-69

Crushing season	Dividends on members' equity	Contingency reserves[1]	Cash on current year's patronage	Revolving fund[2]	Total
			Percent		
1957-58	12.0	0.7	30.3	57.0	100
1958-59	6.9	1.2	38.2	53.7	100
1959-60	5.4	1.2	37.9	55.5	100
1960-61	6.5	0.7	42.0	50.8	100
1961-62	5.7	0.4	41.3	52.6	100
1962-63	5.7	0.1	45.2	49.0	100
1963-64	10.1	0.1	35.3	54.5	100
1964-65	4.4	0.2	42.7	52.7	100
1965-66	3.3	0.1	50.3	46.3	100
1966-67	9.7	0.4	41.7	48.2	100
1967-68	1.4	0.4	38.5	59.7	100
1968-69	0.6	0.3	35.6	63.5	100
Average	6.0	0.5	39.9	53.6	100

[1] Unallocated reserves only.
[2] Includes reserves allocated to patrons.

total dividend earnings of $9.5 million between March 1944 and August 1969. It paid more than $6.5 million in cash to the membership, leaving a deferred balance of $3 million. Thus, it returned more than 68 percent of the earnings in cash.

Another federated independent has refunded to members more than $1.8 million in cash since 1953.

Returns, Revenues, And Costs—Cottonseed Mills

This section discusses the operating results of cottonseed mills in relation to factors affecting revenues and costs. The next section deals with soybean mills.

Emphasis is placed on type and size of plant facilities, milling efficiency, and marketing policies.

Cooperative cottonseed mills range in size from 30 to 1,200 tons daily crushing capacity. Facilities include prepress solvent, direct solvent, and screw press extraction units. Some mills also take oil beyond the crude stage. These and other variables such as

grade of seed have considerable effect on revenues, costs, and operating results.

Returns

Net sales return is a measure of total returns to members. Net margin measures returns to members over and above going market prices. Both measurements are useful in analyzing factors affecting overall operating results.

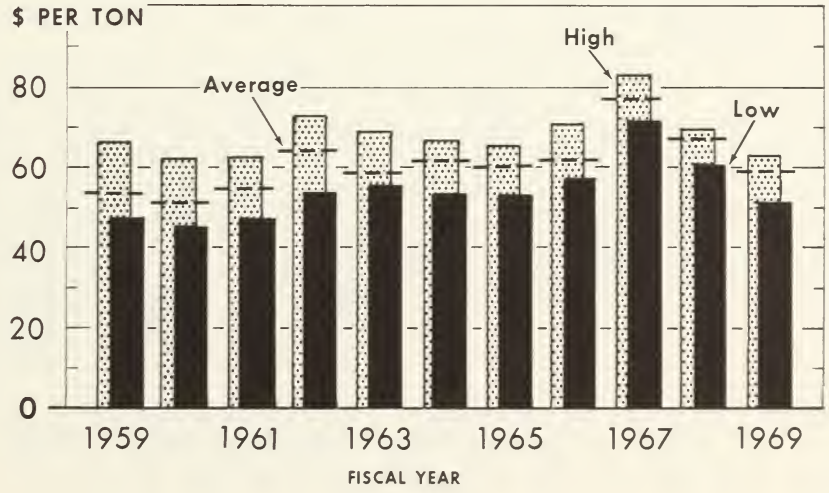
Net sales returns and net margins for cooperative cottonseed mills during the 11-year period, fiscal 1959 through 1969, appear in figures 2 and 3, respectively.

Net sales returns (average for all mills) ranged from $76.59 a ton in 1967 to $51.34 a ton in 1960, a difference of $25.25 (figure 2). The difference between high and low returns within a year was the greatest in 1959 when the range was $18.68. The smallest was in 1968—$9.35 a ton.

Net margins (average for all mills) ranged from $8.93 a ton in 1960 to $2.20 in 1969 (figure 3). The greatest range within a year was $15.61 in 1967; the smallest was a difference of $8.06 a ton in 1960.

One or more mills had a loss in each of 5 years during the 11 year period. Normally, losses occur at only one or two cooperative cottonseed mills in any one season.

FIGURE 2.--NET SALES RETURN PER TON OF COTTONSEED CRUSHED BY COOPERATIVE MILLS



Product Revenues

Gross revenue from cottonseed products has varied widely between seasons and individual mills (figure 4).

Revenue per ton of seed crushed (average all mills) ranged from $97.60 in 1967 to $67.88 in 1960.

The greatest range between mills within a season was in 1962 when the difference was $22.93 a ton of seed crushed. The least difference was $8.60 a ton of seed in 1959.

Variability in revenue between seasons is due to general price levels, supplies of cottonseed, and prices and supplies of competing products such as soybean oil and meal. Major factors affecting variability in revenue within a season are: (1) variability in grade of seed crushed, (2) milling efficiency, and (3) marketing policies.

Variability in Seed

Table 9 shows cottonseed analysis for the three most important products for the 11-year period 1959-1969.

The greatest range in oil content of seed was in 1965 with a high of 22.3 percent and a low of 16 percent or 6.3 percent difference. With the same type of extraction and same milling efficiency, 6.3 percent oil content amounts to 126 pounds a ton of seed. At an

FIGURE 3.--NET MARGIN PER TON OF COTTONSEED CRUSHED BY COOPERATIVE MILLS

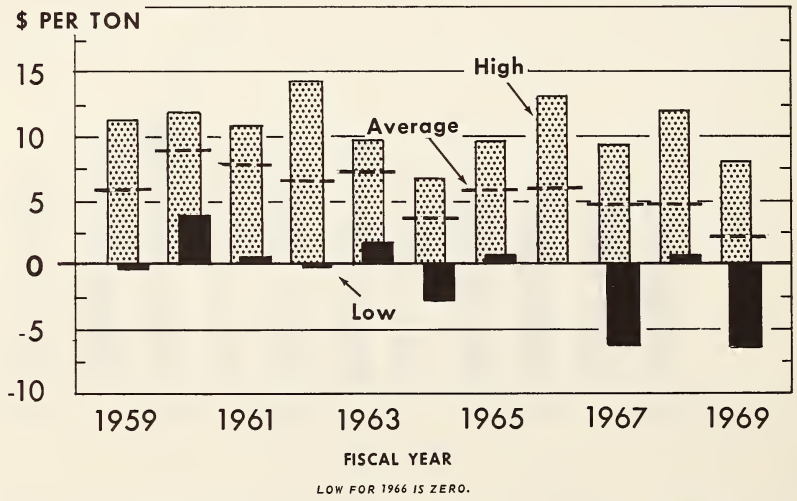


FIGURE 4.--PRODUCT REVENUE PER TON OF COTTONSEED CRUSHED BY COOPERATIVE MILLS

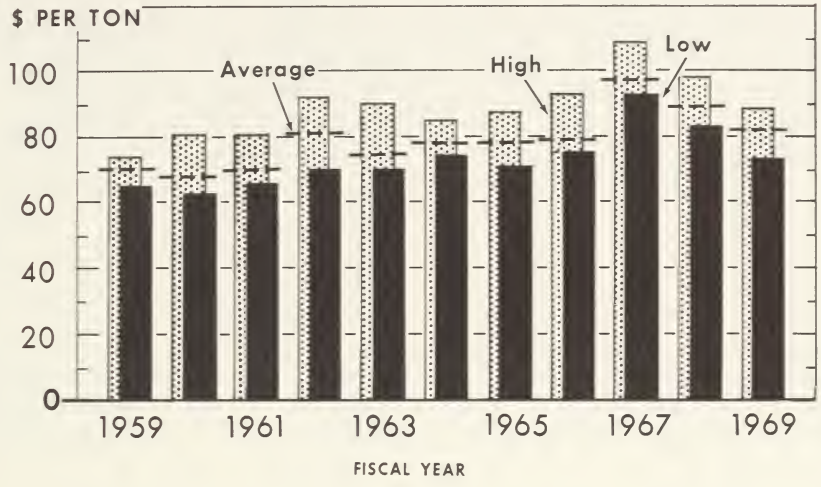


Table 9.—Cottonseed analysis, percentage of oil, ammonia, and linters, cooperative cottonseed mills, fiscal 1959 through 1969

Fiscal year	*Number of mills*	*Oil content*			*Ammonia content*			*Linters content*		
		High	*Low*	*Average*	*High*	*Low*	*Average*	*High*	*Low*	*Average*
					Percent					
1959	14	21.5	17.5	19.0	4.28	3.53	3.91	11.1	9.6	10.4
1960	14	21.8	18.1	18.8	4.27	3.80	3.97	11.1	9.7	10.3
1961	14	21.8	17.8	18.6	4.22	3.74	3.97	10.9	9.2	10.0
1962	15	21.0	17.9	18.8	4.28	3.51	3.87	12.7	9.7	10.6
1963	15	21.5	17.1	18.5	4.18	3.64	3.91	12.4	[1]6.8	10.2
1964	16	21.9	16.9	18.7	4.22	3.77	4.07	12.4	[1]5.0	10.4
1965	14	22.3	16.0	18.7	4.25	3.78	4.04	12.2	[1]6.4	10.4
1966	13	22.1	16.8	18.2	4.20	3.72	4.04	13.7	[1]5.9	10.5
1967	13	21.7	16.9	18.4	4.49	3.78	4.03	12.6	[1]6.5	10.8
1968	10	20.8	16.4	18.1	4.31	3.86	4.05	12.4	[2]	[2]
1969	12	20.5	17.3	18.3	4.20	3.64	3.90	13.2	[1]6.1	10.9

[1] Includes combined upland and long staple seed.

[2] The cooperative mill with the lowest linters content on seed did not obtain analysis of linters in 1968.

oil price of 12 cents a pound, difference in oil revenue would be $15.12 a ton of seed crushed.

Ammonia content of seed indicates expected yield of protein. Cottonseed meal is usually sold on a 41 percent protein basis and the expected yield of 41 percent meal is obtained from the formula:[6]

$$\frac{\text{Percent of ammonia in seed} \times .94 \times 2{,}000}{8 \text{ percent}}$$

Ammonia content of seed varied as much as 0.77 percent (1962). The difference in expected meal yield based on 0.77 percent difference in ammonia content is 181 pounds of 41 percent meal a ton of seed. At a meal price of $70 a ton, 181 pounds amounts to $6.34 a ton of seed.

The range in linters content of seed crushed by cooperative mills began increasing in 1963. Until that time analysis of linters content was for upland seed only. After 1963 mills are included which process combined upland (saw ginned) and long staple (roller ginned). The greatest variation for upland seed was 3 percent (1962). The greatest variation between upland and combined upland and long staple was 7.8 percent (1966). The difference in revenue from linters based on 3 cents a pound and the same milling efficiency amounts to $1.80 a ton for upland and $4.68 a ton of seed for combined upland and long staple.

Expected yield of hulls, the least valuable cottonseed product, is not included in analysis of cottonseed. Hulls are a residual product and usually range from 450 to 550 pounds a ton of seed. The revenue difference for 100 pounds of hulls at a price of $10 to $20 a ton would range from 50 cents to $1 a ton of seed.

Milling Efficiency

Expected yields of cottonseed products are closely associated with grade of seed crushed, as shown in the preceding section. Actual yields, however, are also affected to a great extent by milling efficiency.

Efficiency, as used in this report, refers to both physical yields of products and economic efficiency. For example, solvent extraction yields more oil than screw press extraction but solvent facilities require a greater investment. On a small volume operation, therefore, screw press extraction may be more efficient.

Oil Extraction

The milling variables having the greatest effect on oil yield are type of extraction and residual oil left in extracted flake under the same type extraction.

[6] Rules of National Cottonseed Products Association, Memphis, Tenn.

Taking readings from automated equipment panel board at Plains Cooperative Oil Mill, Lubbock, Tex. This cooperative produces once refined oil by the miscella process.

Cooperative cottonseed mills use three types of extraction: mechanical screw press, direct solvent, and prepress solvent.

Prepress solvent combines the screw press and solvent processes. Cottonseed meats are first sent through screw presses to reduce oil content, then through a solvent extractor. Prepressing is used to increase capacity of the solvent extractor and usually results in greater extraction efficiency. Prepressing, however, requires more labor and repair expense than the direct solvent method.

In recent years, cooperative mills converting from screw press to solvent extraction, or prepress solvent plants replacing existing solvent extraction units, have gone to the direct solvent method.

Table 10 shows relative extraction efficiency of prepress solvent, direct solvent, and screw press methods. It also shows variation in efficiency between seasons for individual mills.

Relative physical efficiency of extraction methods in pounds of oil recovered per ton of seed appear in table 11. Prepress solvent extraction on 18 percent oil in seed yielded 352 pounds of oil or 9 pounds over direct solvent and 36 pounds more than screw presses. Direct solvent averaged 27 pounds over screw press.

The relative economic efficiency of various oil extraction methods

Table 10.—Percentage of oil in seed recovered by various extraction methods, 11 cooperative cottonseed mills, fiscal 1959 through 1966

Extraction method and mill code number	*Percent oil recovered*		
	High	*Low*	*Average*
	Percent		
Prepress solvent:			
Mill 1	99.2	94.1	97.3
Mill 2	100.0	97.2	98.1
Mill 3	98.1	97.0	97.6
Average, 3 mills			97.7
Direct solvent:			
Mill 1	95.9	93.0	94.4
Mill 2	98.3	90.7	95.5
Mill 3	97.1	93.7	95.7
Average, 3 mills			95.2
Screw press:			
Mill 1	88.6	85.4	86.7
Mill 2	90.2	85.6	89.1
Mill 3	88.3	85.8	86.9
Mill 4	90.1	85.3	88.0
Mill 5	88.9	87.0	87.9
Average, 5 mills			87.7

depends on several factors including differences in investment and operating costs; price of oil; annual volume of seed crushed; and premium, if any, for screw press meal over solvent extracted meal.

Operators of screw press mills can estimate how much their revenue would be increased if they converted to solvent extraction. The formula used in determining this is given in the appendix.

Appendix tables 1, 2, and 3 give estimated net increases in revenue for prepress over screw press, direct solvent over screw press, and prepress over direct solvent for oil prices 8 cents through 15 cents a pound for annual crushes of 40,000 tons, 50,000 tons, and 60,000 tons. Appendix table 1 gives this information when solvent meal is not discounted; appendix tables 2 and 3 cover screw press meal at premiums of $1 and $2 a ton, respectively.

Oil left in meal varies between mills with the same type of extraction. Prepress solvent plants leave around 0.5 to 1 percent and direct solvent mills leave from 1 to 2 percent in meal. Screw press

Table 11.—Differences in cottonseed oil yields by type of extraction[1]

Type of process	*Total oil by seed receipt analysis*	*Percentage oil recovered*	*Oil produced*	*Advantage over screw press*
	Pounds	*Percent*	*Pounds*	*Pounds*
Prepress solvent	360	97.7	352	36
Direct solvent	360	95.2	343	27
Screw press	360	87.7	316	—

[1] Based on seed containing 18% oil.

plants leave 3 to 5 percent and average around 4 percent oil in meal (table 12).

Screw press mills leave different oil content in meal for various reasons. Some screw press mills in areas with little, if any, local market for meal tend to extract as much oil as possible. In areas where local meal markets exist and screw press meal sells for a premium over solvent meal, they tend to leave a greater amount of oil in meal.

Annual surveys of cooperative mills show the premium for screw press meal in most areas has been decreasing in recent years. Management needs to evaluate oil left in meal in relationship to meal premium. For example, a screw press mill leaving an optional 4.5 percent oil in meal when 3.5 percent could be obtained loses revenue from around 9 pounds of oil a ton of seed crushed (based on 900 pounds meal yield). At 12 cents a pound, 9 pounds of oil amounts to $1.08 a ton of seed and a premium of around $2 a ton on meal would be required to offset the difference of 1 percent oil left in meal.

Table 12.—Variation in oil content of meal, screw press plants, cooperative cottonseed mills, 1958-59 through 1967-68

Season	*Mills*	*Oil content of meal*		
		High	*Low*	*Average*
	Number	*Percent*		
1958-59	8	5.0	3.3	4.1
1959-60	8	4.6	3.0	4.0
1960-61	8	4.7	3.5	4.2
1961-62	9	4.8	3.4	4.0
1962-63	9	5.0	3.3	4.1
1963-64	9	4.9	3.2	4.0
1964-65	9	4.6	3.3	4.1
1965-66	10	4.6	3.3	3.9
1966-67	10	4.5	3.2	4.0
1967-68	6	4.6	3.8	4.2

Meal Production

Milling efficiency in regard to meal production, other than oil left in meal, centers around protein and moisture control.

The bulk of cottonseed meal is sold on 41 percent basis. Most State feed laws require sellers of cottonseed meal to guarantee the protein content of meal shipments. If a shipment does not meet its protein guarantee, it is subject to rejection, or a purchase discount and in some cases the seller may be subject to litigation. Conversely, if protein content is greater than the guarantee, the seller normally does not receive additional premium.

Protein content of seed is not uniform and mills encounter difficulty in maintaining meal production at 41 percent protein. Usually, all mills average close to 41 percent for the season's production, but a frequency distribution of daily grind-room samples is a more accurate measurement of protein control.

A study of six selected screw press mills during the 1958-59 season showed the effectiveness of different protein control methods (5). Major results of this study are given in table 13 and figure 5. Five of the six study mills controlled protein by adding hulls to cottonseed meats prior to extraction. Under this method, meal grindroom (finished meal) samples are necessarily analyzed after hulls have been added and meal is ready for shipment.

One of the six mills added hulls to press cake after extraction. This mill used two press cake bins. Current cake production was conveyed into one bin while grinding out of the second bin containing cake produced the day before. In this method, analysis of cake was available before grinding took place and served as a guide to the amount of hull material and moisture needed to control each specific day's meal production.

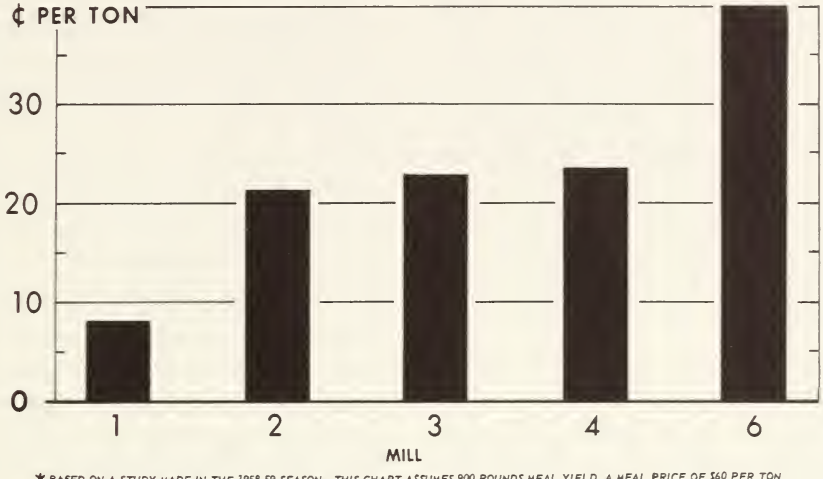
The effectiveness of the two protein control methods is shown in table 13. Mill 1, which added hulls after extraction, did not have any meal production under 40 percent or any above 42 percent protein and had 86.6 percent of its total meal production within 40.5 to 41.5 percent protein range. The other five mills had a much greater variation and the

Table 13.—Protein content of cottonseed meal production, 6 selected screw press mills, 1958-59 season[1]

Percent protein	*Mill 1*	*Mill 2*	*Mill 3*	*Mill 4*	*Mill 5*	*Mill 6*
			Percent			
Below 39.5	—	3.2	2.8	14.4	22.8	16.7
39.5-39.9	—	14.8	1.3	7.6	9.1	6.3
40.0-40.4	6.0	17.8	10.5	13.2	40.9	6.4
40.5-40.9	44.9	15.5	28.4	16.8	9.1	8.2
41.0	15.9	3.4	9.3	3.9	9.1	2.2
41.1-41.5	25.8	18.6	18.6	15.9	4.5	10.1
41.6-42.0	7.4	11.6	11.9	9.2	—	12.0
42.1-42.5	—	7.5	12.4	4.1	—	9.4
Above 42.5	—	7.6	4.8	14.9	4.5	28.7
Total	100.0	100.0	100.0	100.0	100.0	100.0
Below 40.5	6.0	35.8	14.6	35.2	72.8	29.4
40.5-41.5	86.6	37.5	56.3	36.6	22.7	20.5
Above 41.5	7.4	26.7	29.1	28.2	4.5	50.1
Total	100.0	100.0	100.0	100.0	100.0	100.0

[1] Based on daily grind room samples (finished meal).

FIGURE 5.--REVENUE LOSS ON SALES OF COTTONSEED MEAL OF EXCESS PROTEIN, PER TON OF SEED CRUSHED, 5 SELECTED SCREW PRESS MILLS*



* BASED ON A STUDY MADE IN THE 1958-59 SEASON. THIS CHART ASSUMES 900 POUNDS MEAL YIELD, A MEAL PRICE OF $60 PER TON, AND HULL PRICE OF $10 PER TON. MILL 5 OMITTED BECAUSE ITS MEAL WAS BELOW THE 41 PERCENT PROTEIN LEVEL.

percent of total meal production within 40.5 to 41.5 percent protein ranged from 56.3 percent for Mill 3 to 20.5 percent for Mill 6.

Effective protein control methods can increase meal revenue significantly. Mill 1, the only mill adding hull material in the grind room, had as little as 8.1 cents loss in net revenue per ton of seed crushed as contrasted with 21.3 cents for Mill 2, 22.8 cents for Mill 3, and 40 cents for Mill 6 (figure 5).

Moisture content of meal varies considerably among cooperative mills, especially screw press plants.

Moisture content of solvent produced meal ranges from about 9 to 12 percent. Moisture content of screw press meal ranges about 9.5 to 4.5 percent and averages about 7 percent (table 14).

The moisture content of meal at screw presss plants depends to a great extent on the moisture of press cake and on area humidity levels. However, producing meal with as high a moisture content as can be obtained within limits set by oil extraction efficiency and storage conditions can increase hull revenue significantly.

Linters Production

Linters production involves more economic factors than any other cottonseed product. Although linters content of seed

Table 14.—Variation in moisture content of meal, screw press plants, cooperative cottonseed mills, 1958-59 through 1968-69

Season	Mills	Moisture content of meal		
		High	Low	Average
	Number	Percent		
1958-59	8	9.3	5.0	7.0
1959-60	8	9.7	4.9	7.2
1960-61	8	9.5	4.9	7.6
1961-62	9	9.5	4.5	7.3
1962-63	9	9.5	4.8	7.3
1963-64	9	8.9	4.4	7.1
1964-65	9	9.7	4.3	7.2
1965-66	10	9.4	4.2	7.0
1966-67	10	9.1	4.1	6.8
1967-68	6	8.8	3.5	7.2
1968-69	6	7.9	4.6	6.3

limits total linters production, management makes such decisions as: (1) How much of total linters available on seed can be economically recovered, and (2) the ratio of first cut (felting grade) linters to second cut (chemical grade) linters.

Linters left on delinted seed at cooperative mills range about 25 to 55 pounds and average about 40 pounds a ton of seed crushed. Prices of second cut (chemical) linters vary widely, being almost two to three times as great in some years as in others (table 15).

Delinting is a costly operation. All cooperative mills delint seed to the point they consider necessary for efficient oil extraction. How-

Table 15.—Linters left on delinted seed a ton of seed crushed and prices received for second cut linters, cooperative cottonseed oil mills, 1958-59 through 1968-69

Season	Linters left on delinted seed[1]			Prices received for second cut linters		
	High	Low	Average	High	Low	Average
	Pounds			Cents per pound		
1958-59	53	20	38	2.6	1.6	2.2
1959-60	50	18	33	3.1	2.1	2.5
1960-61	55	27	42	3.7	2.8	3.3
1961-62	54	22	37	5.5	4.5	5.2
1962-63	53	20	38	3.9	2.8	3.3
1963-64	62	27	41	3.5	2.8	3.1
1964-65	60	23	40	3.5	2.7	3.0
1965-66	51	32	41	3.9	3.1	3.5
1966-67	58	30	45	6.9	5.5	6.2
1967-68	49	30	41	6.8	4.1	4.9
1968-69	62	38	48	5.3	3.6	4.1

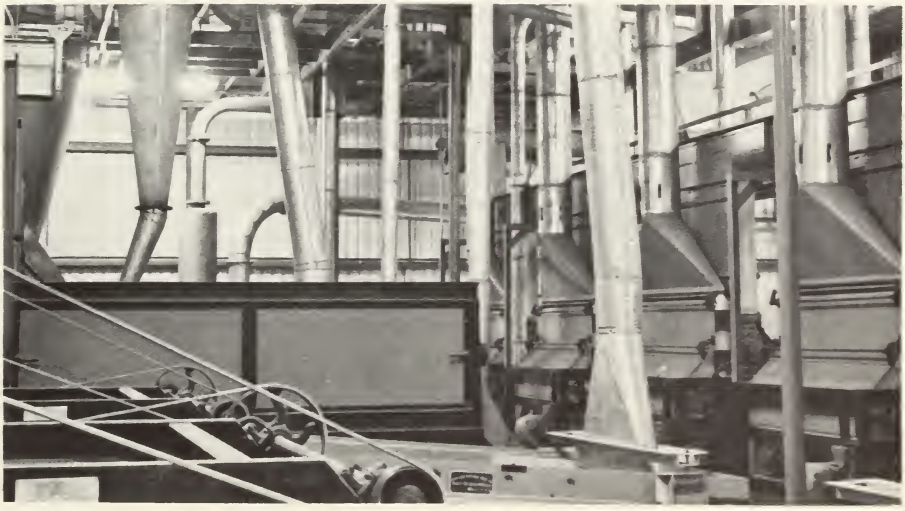
[1] Calculated by formula 2,000 lbs. less linters produced x lint content of delinted seed.

ever, in some years the price of second cut linters may be sufficiently low for management to consider leaving more linters on delinted seed than normal. Several factors are involved—the main ones being price of hulls (lint left on delinted seed remains on hulls and increases hull revenue accordingly) and savings on power costs.

A study of the economics of delinting cottonseed to low residual linters levels at oil mills showed that costs vary greatly between individual mills (6). Each mill operator needs to make his decision on level of delinting based on his individual cost data. Illustrative calculations that can be used by operators are given in appendix table 4.

Cooperative mills vary widely in the proportion of first cut to second cut linters. The yield of first cut is dependent to a large extent upon the linters content of seed. For example, if seed is delinted for first cut linters to around 8 percent residual lint on seed, then seed with 12 percent linters content would yield about twice as much first cut linters as seed with 10 percent linters.

Although first cut linters yield is largely dependent on linters content of seed, it can usually be increased at the cost of lower grade and price. Within limits imposed by demand for the higher grade first cuts, mills should produce that ratio of first to second cut linters that will produce maximum revenue from total linters production.



New delinting room at Yazoo Valley Oil Mill, Greenwood, Miss. Linters have high speed, 18 inch saws giving each machine twice the capacity of those replaced.

Marketing Policies

Marketing products is one of the most important and difficult aspects of mill management. A major complicating factor is that cottonseed mills receive almost all their season's crush within a 2 to 3-month period.

The oil mill price of seed is usually based on anticipated outturns and prevailing prices for products at the time seed is received. Product prices may change considerably during the year and the primary problem is to reduce the risk of price declines from the time seed is delivered until products are manufactured and ready for market.

In absence of government price support programs, the normal channels of price protection are hedge positions in futures markets and actual sale of products for forward delivery.

Futures Markets

There are no organized futures markets for cottonseed, crude cottonseed oil, linters, and hulls. Only two products can be bought and sold on futures markets—refined oil at New York and Chicago and meal at Memphis.

Cooperative cottonseed mills make very little direct use of futures markets. A survey in 1967 showed that none of 15 mills were using the futures for meal. Only one mill used the futures for oil and that was only when management thought the spread between crude and refined was greater than normal.

Among reasons given for not making direct use of futures markets were problems of delivery on contracts. Crude oil was produced at 12 of the 15 mills and only refined oil is deliverable under the futures contract. Delivery points for meal are restricted to an area fairly close to Memphis and mills located in distant areas think freight rates to make physical delivery would be prohibitive.

Forward Selling

Most cooperative cottonseed mills reduce price risk by making sales for forward delivery, especially oil and meal. The extent of forward sales varies by mill and product.

A larger percentage of oil than of any other product is sold forward. Oil is used in edible products which have a year-round consumption pattern. Refiners and further processors of oil purchase on forward sales basis to assure themselves a supply.

Mills can make forward sales of oil for delivery several months ahead of production. Prices tend to become lower the further the scheduled delivery month is from the date of sale since purchasers then are taking the price risk.

Mills tend to make forward sales on meal in excess of that quantity

used for local demand. Usually, forward sales are made to large consumers.

Forward selling of linters varies from none to contracting an entire season's production to one linter buyer.

Hulls are usually sold as produced. However, a few forward sales are made to large commercial feeders.

Cottonseed mills cannot obtain complete hedges against price risks on all products. Even when a product such as oil can be sold forward several months ahead of production, price tends to decline the further the delivery month is from date of sale. Therefore, the protection gained through forward sales usually is at a cost of reduction in the operating margin a mill hopes to attain.

As might be expected, marketing policies range from tendencies to sell as much production forward as possible at the time seed is delivered to selling products as they are manufactured. Some mills have definite marketing policies such as selling a certain percentage of oil and meal forward as seed is delivered. Most mills, however, have flexibility in their policies.

There are no hard and fast rules on which to base marketing policies. A policy of selling forward will give best results in a season of declining prices. Selling as produced will give the best results in a season of rising prices.

Guidelines

Although no one marketing policy will give the highest product prices every season, cooperatives need to consider some guidelines.

Selling as produced tends toward speculation with resulting high operating margins in some years and offsetting low margins or losses in other years. Operating losses are difficult to handle at cooperatives and tend to lower members' confidence.

Selling products forward as seed is received tends to narrow the range of margins from year to year but minimizes the risk of operating losses.

When setting product marketing policies, the board of directors should consider the overall effect on members' attitudes as well as operating margins.

Costs

Costs of crushing cottonseed vary widely among cooperative mills. Crushing capacity, one of the main factors affecting costs, ranges from 30 to 1,200 tons of seed a day. Length of operating season, another important factor, ranges from about 4 months to a full year. Wage rates in some areas are about double those in others. Mills in areas with local meal and hull markets incur greater handling costs than those selling to wholesale markets. Also, mills

processing oil beyond the crude oil stage incur additional costs.

Variations and trends in total costs appear in figure 6. Inflation and decreasing cotton production are responsible for increasing costs in recent years.

The effect of volume is clearly shown during 1967, 1968, and 1969. Average crushing capacity used during these years was 62, 55, and 69 percent, respectively, compared to around 75 percent in prior years.

Most cooperative mills classify costs as transportation (freight on seed), manufacturing, administrative, and financial.

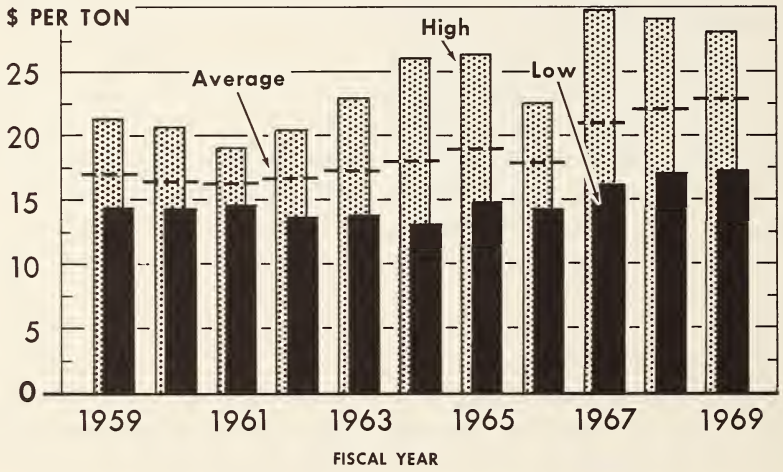
Transportation

Freight on seed from gins is usually the only transportation cost mills incur and averages around 15 percent of total costs. Manufactured products are normally sold f.o.b. at the mill.

Cooperative mills generally do not own trucks for hauling seed and transportation is primarily a gin responsibility. Some gins own trucks but generally they depend on outside truckers.

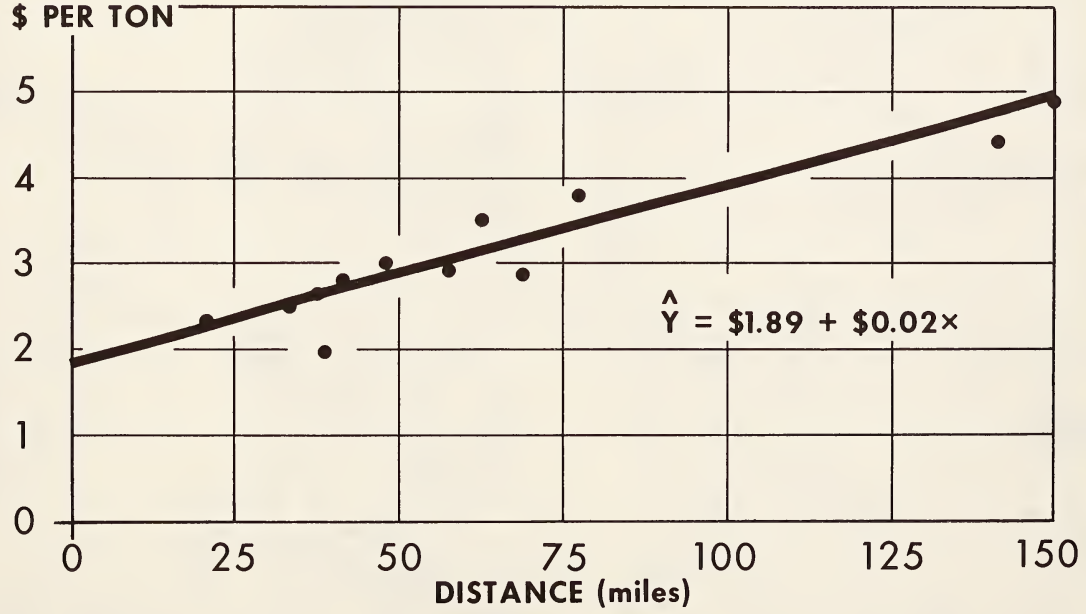
Each cooperative mill sets up a schedule of transportation costs to each gin from which it receives seed. When an initial advance or

FIGURE 6.--TOTAL COST PER TON OF COTTONSEED CRUSHED BY COOPERATIVE MILLS



A truck load of cottonseed at one of several seed dumps at the cottonseed mill of Plains Cooperative Oil Mill, Lubbock, Tex.

FIGURE 7.--AVERAGE COST PER TON FOR HAULING COTTONSEED FROM GIN TO COOPERATIVE MILLS IN TEXAS, NEW MEXICO, OKLAHOMA, ARKANSAS, AND MISSISSIPPI, 1965-66



payment is made on seed, transportation costs are added to the amount due gins or patrons. The cooperative mill pays a uniform basis price f.o.b. each gin plus seed transportation costs thereby pooling or averaging freight costs among all patrons.

Freight on inbound seed during the 1965-66 season ranged from about $2 to $5 a ton. The main variable was mileage. The freight cost at cooperative mills based on mileage can be estimated by the formula y = $1.89 + $0.02 a mile (figure 7). This estimating formula indicates a fixed charge of $1.89 a ton plus 2 cents a mile. Figure 7 also shows that average hauling distance ranges from about 20 to 150 miles but is grouped in the 20 to 80 mile range.

Manufacturing

This classification averages about 65 percent of total costs. It includes costs and expenses directly attributable to the manufacturing process. The most important single cost item is wages and salaries of those working in the mill proper. Depreciation and repair expenses are next, followed by cost of power. Other cost items include insurance, packaging supplies, and solvent.

Wages and Salaries—Mill wages and salaries include all labor and supervision costs involved in taking seed through unloading and processing, and the loading of finished products. Requirements for labor at a given mill vary during the crushing year. The peak requirement is at seed receiving time; the low is during the dormant season.

Wages and salaries per ton of seed differ widely among cooperative mills (figure 8). Wage rates range from the minimum required by law to twice that. Other important factors are size of mill, length of operating season, building layout, sack or bulk shipment of meal and hulls, pelleting, feed mixing, further processing of oil, and amount of repair and construction work done by mill labor.

Depreciation and Repairs—Depreciation and repair expense is second to mill wages and salaries as the largest cost crushing seed.

Figure 9 shows average repair and depreciation expenses for the 11-year period 1959 through 1969. Except for short cotton production for fiscal years 1967, 1968, and 1969—combined repair and depreciation expenses have increased only slightly during the 11-year period, moving up from around $3 to $3.50 a ton.

Power and Fuel—The third highest cost of crushing seed is for power and fuel. This cost has been fairly stable for 11 years at around $1.95 a ton (figure 10).

The variation in cost among cooperative mills is due to differences in consumption and rates schedules.

A detailed study of effects of

FIGURE 8.--MILL WAGE COST PER TON OF COTTONSEED CRUSHED BY COOPERATIVE MILLS

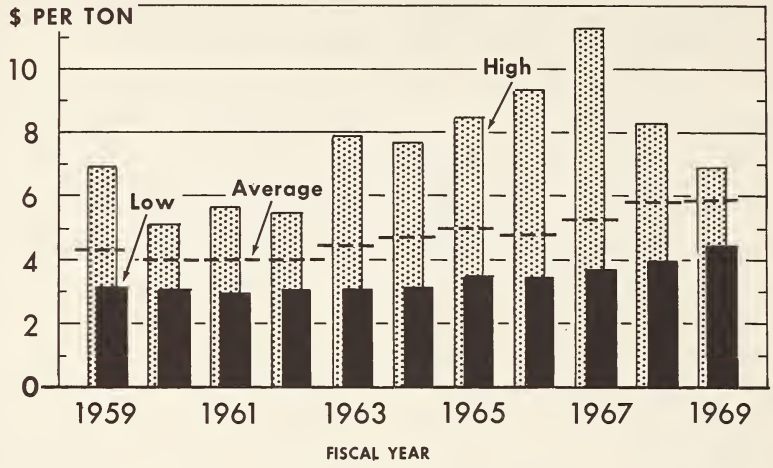


FIGURE 9.--DEPRECIATION AND REPAIR COST PER TON OF COTTONSEED CRUSHED BY COOPERATIVE MILLS

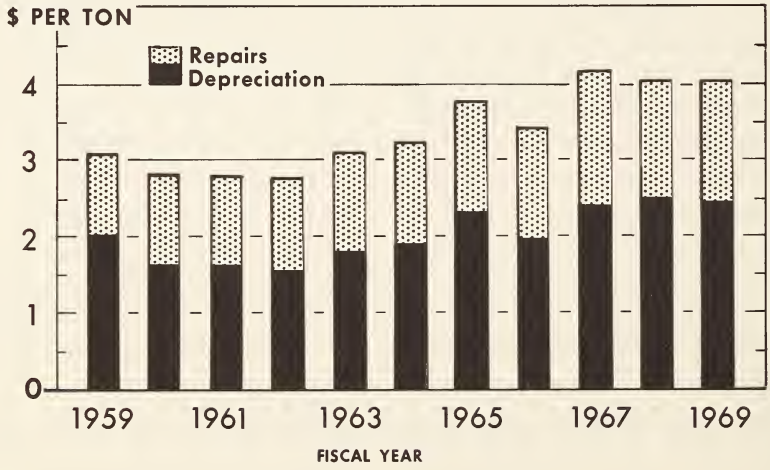
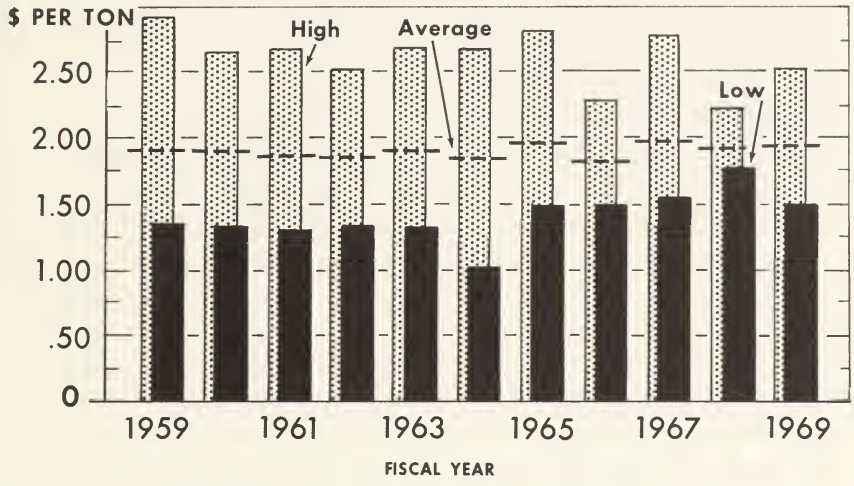


FIGURE 10.--POWER AND FUEL COST PER TON OF COTTONSEED CRUSHED BY COOPERATIVE MILLS



electric power rates for the 1963-64 season at 13 cooperative mills showed that equivalent amounts of power under the highest rate cost 75 percent more than under the lowest rate (7). A conclusion of this study was that electric rate schedules should be studied and reviewed frequently to evaluate changes in relationships of oil mill operations to cost factors faced by suppliers of power.

Insurance—Cooperative mills' insurance costs include coverage on buildings and equipment, stored cottonseed and products, boiler explosion, business interruption, fidelity bonds, general or public liability, product liability, and auto and truck insurance.

Since many factors enter into insurance rates, this expense differs widely among cooperative mills. During the 11-year period 1959 through 1969, cost of insurance per ton of seed crushed ranged from about 30 cents to $1 with an average of 50 cents to 60 cents a ton.

Packaging Supplies—Cottonseed packaging supplies include sacks and twine used for meal and hulls and bagging and ties for linters. The cost of sacks and twine per ton of seed crushed depends to a great extent on the percentage of meal or hulls sold in sack form. Cost of sacks is recovered by pricing sacked products higher than bulk. At several cooperative mills this cost is deducted from

meal and hull sales and therefore is not included in expenses in this report.

Expense of bagging and ties depends largely on linter content of seed and extent to which linters are removed. In 1969 bagging and ties ranged in cost from 67 cents to 33 cents and averaged 45 cents a ton of seed crushed.

Other Costs—Manufacturing expenses also are incurred for mill supplies, analysis on seed and mill samples, solvent, and miscellaneous needs.

Mill supplies include such items as lubricating oil and grease. Average mill supplies expense for all cooperative mills during the 11-year period ranged from 17 cents to 45 cents a ton of seed crushed.

Laboratory analysis in 1969 ranged in cost from 10 to 47 cents and averaged 29 cents a ton of seed crushed. Some cooperative mills have complete or partial laboratories of their own for analysis of mill samples.

Solvent expense at solvent mills ranged from 12 to 67 cents in 1969 and averaged 30 cents a ton of seed crushed. This expense is affected by efficiency of solvent recovery systems and production of crude or refined oil. If other factors are equal, miscella refining uses a greater amount of solvent then crude oil operations.

Miscellaneous manufacturing expense includes such items as demurrage on railroad cars and varies considerably by mill and season. For the 11-year period 1959 through 1969, average miscellaneous manufacturing expense for all mills ranged from 7 to 32 cents a ton of seed crushed.

Administrative

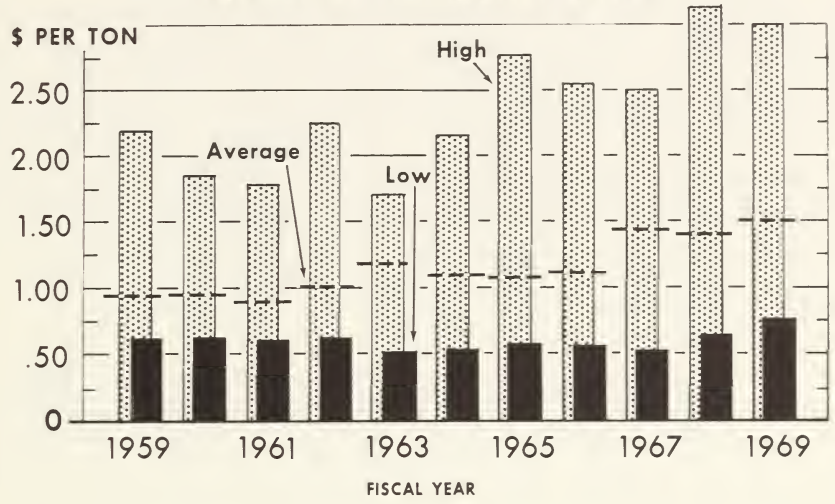
Administrative cost which averages around 15 percent of total costs includes managers' and office salaries; brokerage; taxes and licenses; travel and auto expense; telephone; dues, subscriptions, and advertising; legal and audit; and office supplies.

Office salaries and bonuses account for approximately one-third of total administrative costs. This expense rose slightly from 1959 through 1966 with major increases in 1967 through 1969 when cotton production was extremely short (figure 11).

Taxes and licenses have increased steadily in the last decade. The average for all mills rose from about 4 cents a ton of seed in 1959 to 51 cents in 1969. Taxes and licenses are largely fixed costs. In the short cotton crop years of 1967 and 1968 they averaged 64 cents and 70 cents a ton, respectively.

All cooperative mills pay brokerage on oil sales. Brokerage on meal, hulls, and linters varies depending on percentage of these products sold on wholesale markets. During the 11-year period 1959 through 1969 brokerage expense for individual mills ranged

FIGURE 11.--SALARY COST PER TON OF COTTONSEED CRUSHED BY COOPERATIVE MILLS



from approximately 20 cents to 40 cents a ton of seed crushed with an average of about 30 cents.

Most cooperative mills are members of state and national organizations of cottonseed crushers. Dues to these organizations, advertising, and subscriptions to publications range from about 10 cents to 40 cents a ton of seed. For all mills, the average is approximately 20 cents a ton.

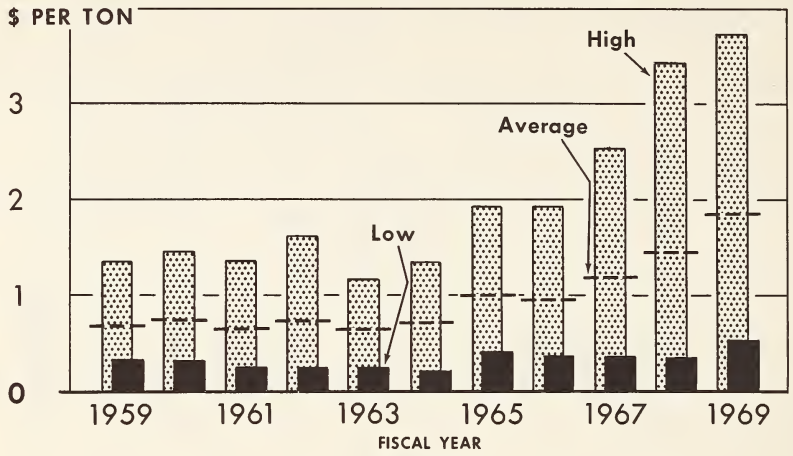
Travel and auto expense varies considerably among cooperative mills. It ranges from about 10 cents a ton of seed for mills whose member gins are in a concentrated area to about 50 cents for those whose member gins cover a relatively wide area. The average for all mills in 1969 was 20 cents a ton of seed.

Other administrative expenses in 1969 averaged 9 cents a ton for telephone and telegraph; 7 cents for legal and audit; and 26 cents for miscellaneous.

Financial Expenses

Financial expense at cooperative mills—mostly interest on facility loans and short-term capital to make initial payments or advances on seed—averages about 5 percent of total costs. Only a few cooperative mills pay Federal and State income taxes. These taxes are paid on non-member business and amount to about 10 cents a ton of

FIGURE 12.--INTEREST AND BANK CHARGES PER TON OF COTTONSEED CRUSHED BY COOPERATIVE MILLS



seed crushed for those mills affected.

Interest costs vary considerably at cooperative mills because of differences in facility loans, length of operating season, and working capital. The range and average interest costs for the 11-year period 1959 through 1969 appear in figure 12.

Rising interest rates beginning in 1965 had considerably more effect on large-volume modernized mills than on smaller volume, depreciated plants. The range between the highest and lowest interest expense was $1.37 to 21 cents a ton of seed in 1964 and by 1969 was $3.12 to 53 cents. The average interest expense increased from 72 cents a ton in 1964 to $1.88 in 1969.

Returns, Revenues, And Costs—Soybean Mills

Operating results vary widely among cooperative soybean oil mills—by geographic location, by seasons, and by individual mills. Size of plant, grade of beans, local markets for meal, distance from oil refining and consuming centers, concentration of bean production, wage rates, degree of further processing, and tax and public

utility rates all affect operating results.

Returns, revenues, and costs also vary considerably between large scale solvent and small scale screw press plants. Since only a token volume of beans is processed by screw press plants, both by cooperatives and throughout the industry, this section deals only with solvent plants.

Returns

Net sales returns to patrons of cooperative soybean plants for the 11-year period fiscal 1959 through 1969 are shown in table 16.

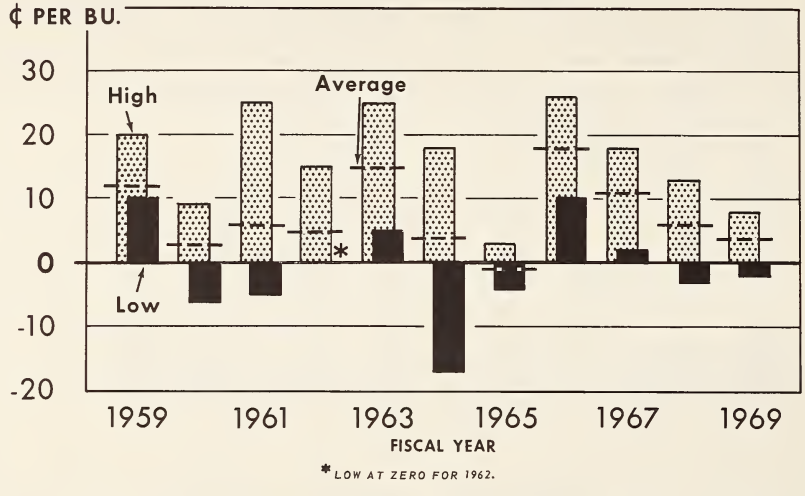
Average net sales returns ranged from $2.05 in 1960 to $2.95 in 1967 per bushel of beans crushed. The greatest difference between high and low returns within a season was in 1961 when the range was from $2.29 to $2.56—27 cents a bushel. The least difference was in 1967 when the high was $2.98 and the low was $2.92.

Net margins, the amounts patrons of cooperative soybean mills receive over and above going market prices in their respective areas, are shown in figure 13. Average net margins for all mills for the 11-year period 1959 through 1969 ranged from a high of 18 cents a bushel in 1966 to a loss of 1 cent in 1965. Within a season, the greatest range was in 1964 when the high was 18 cents and the low was a loss of 17 cents a bushel.

Table 16.—Net sales returns to members per bushel of soybeans processed by cooperative mills, fiscal 1959 through 1969

Fiscal year	*Mills*	*Net sales return*			*Difference between high and low*
		High	*Low*	*Average*	
	Number	*Dollars per bushel*			
1959	4	2.28	2.21	2.25	.07
1960	6	2.12	2.02	2.05	.10
1961	8	2.56	2.29	2.45	.27
1962	7	2.52	2.40	2.48	.12
1963	8	2.58	2.47	2.53	.11
1964	9	2.61	2.52	2.55	.09
1965	10	2.77	2.62	2.72	.15
1966	9	2.99	2.87	2.94	.12
1967	10	2.98	2.92	2.95	.06
1968	10	2.71	2.55	2.66	.16
1969	12	2.67	2.51	2.56	.16

FIGURE 13.--NET MARGIN PER BUSHEL FOR SOYBEANS PROCESSED BY COOPERATIVE SOLVENT MILLS



One or more mills had losses in 6 of the 11 years.

Product Revenues

Revenue from sales of soybean products varies widely between seasons and between individual mills. The average revenue for all mills per bushel of beans crushed ranged from a low of $2.26 in 1960 to $3.11 in 1967 (figure 14). Within a season, the greatest difference between mills was in 1968 when the high mill had revenue of $2.90 a bushel and the low mill $2.67. The narrowest range was in 1963 from a high of $2.72 to a low of $2.65.

Variability in Beans

There has been some increase in the yield of oil and to a lesser extent in meal over the past 25 years. Increased oil yield has resulted from the almost complete shift to solvent extraction and to new varieties of soybeans with higher oil content.

Generally, oil content of beans tends to be higher in the South and to decline toward the North. Conversely, protein tends to be higher in the North and declines toward the South.

Oil and protein content are not grading factors in soybeans as they are in cottonseed.

Yields of products per bushel of

FIGURE 14.--PRODUCT REVENUE PER BUSHEL FOR SOYBEANS PROCESSED BY COOPERATIVE SOLVENT MILLS

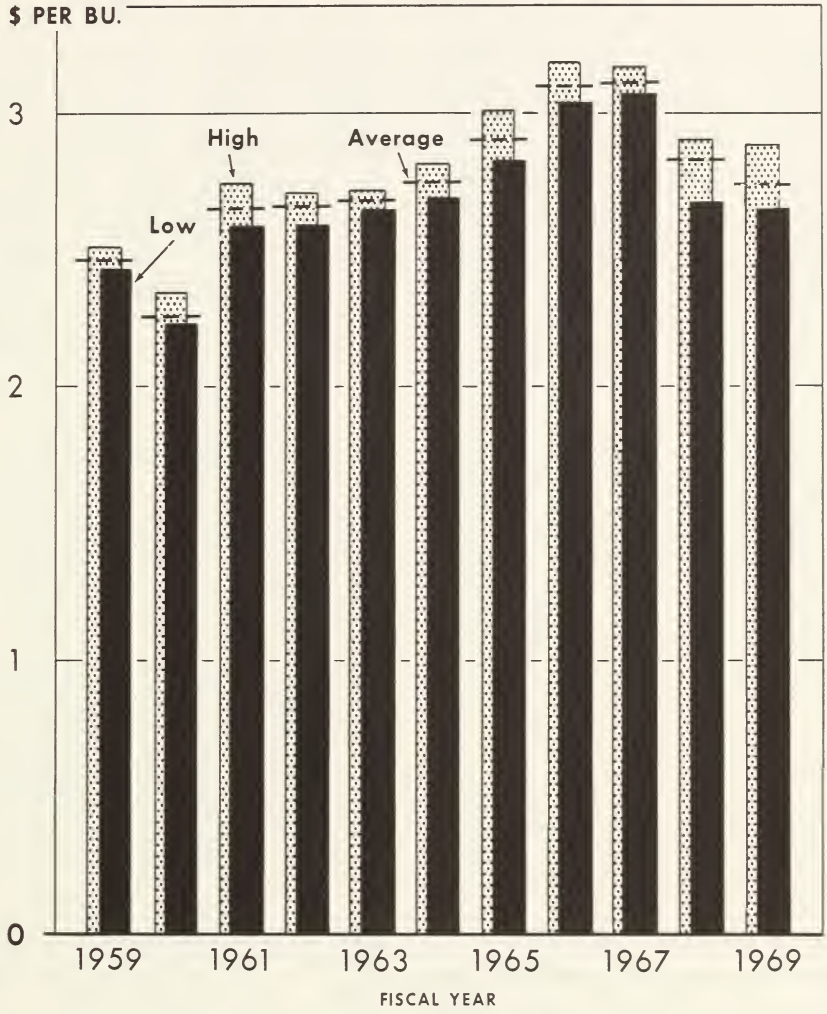


Table 17.—Oil and meal yield per bushel of beans crushed at cooperative mills, fiscal 1959 through 1969

Fiscal year	Mills	Oil yield per bushel			Meal yield per bushel		
		High	Low	Average	High	Low	Average
	Number	Pounds			Pounds		
1959	4	10.95	10.51	10.72	49.71	47.81	48.54
1960	6	11.40	10.07	10.75	48.69	47.11	47.99
1961	7	11.84	10.67	10.90	49.31	46.25	47.75
1962	6	11.19	10.58	10.86	49.12	47.25	48.14
1963	7	10.68	10.16	10.34	49.24	46.72	47.88
1964	9	11.52	10.19	10.73	50.07	47.12	48.42
1965	10	11.04	10.21	10.61	49.60	48.00	48.81
1966	9	11.18	10.16	10.55	49.11	48.19	48.60
1967	10	11.01	10.56	10.74	48.92	48.55	48.81
1968	10	10.90	10.28	10.74	49.62	47.54	48.81
1969	12	11.30	10.23	10.44	48.77	46.90	47.90

beans crushed by cooperative solvent mills in the 11-year period ending in 1969 are shown in table 17. The difference in the amount of oil between the high and low mills averaged about a pound. There was a little more variation in meal yield.

Oil Extraction

The most important milling variables affecting oil yield are the oil content of the beans and the residual oil left in the meal.

Residual oil left in meal by cooperative soybean processors has shown an upward trend (table 18). Between 1960 and 1965, the average for all mills was 1 percent or less. Since then it has ranged from 1.01 percent to 1.4 percent. During the entire 10-year period, the low mill was always 1 percent or less. The high mill has had residual oil of about twice that.

Another factor of economic importance in connection with oil

Table 18.—Residual oil left in soybean meal produced by cooperative mills, fiscal 1959 through 1969

Fiscal year	Mills	Residual oil in meal		
		High	Low	Average
	Number	Percent		
1960	6	1.90	.50	.96
1961	8	1.20	.70	.78
1962	7	1.36	.70	.87
1963	8	1.30	.60	1.00
1964	8	1.20	.60	.98
1965	10	1.71	.80	1.01
1966	10	1.80	.80	1.10
1967	11	2.20	1.00	1.20
1968	11	2.20	1.00	1.40
1969	12	2.33	1.00	1.28

extraction is the refining loss. Rule 102, Part C, of the Trading Rules of the National Soybean Processors Association states:

"Adjustment for Loss. Shipper shall pay consignee for loss at the rate of 1 percent of the contract price for each 1 percent loss above 5 percent calculated on the official net weight of crude. When the crude oil delivered analyzes with a loss under 5 percent, the consignee will credit the shipper at the rate of 1 percent of the contract price for each 1 percent under 5 percent up to a maximum credit of 4.5 percent of the contract price, calculated on the official net weight of the crude. Loss is to be figured fractionally throughout."

Refining loss on oil produced at cooperative mills has shown a downward trend (figure 15). During the period 1960 through 1969, the loss declined from approximately 4 percent to about 2.5 percent. Thus, it is apparent that cooperative processors have been receiving substantial premiums on their oil. Data in figure 15 are based on those mills producing crude oil only. Mills with degumming or refining equipment have been excluded.

Meal Production

Milling efficiency in connection with meal production, other than residual oil, concerns protein and moisture control.

All except one of the cooperative mills are equipped (or in the process of installing equipment) to produce 50 percent protein meal. To do this, beans must be dehulled before extraction. A good job of dehulling is necessary to produce not only 50 percent protein but also to hold the fiber content of the meal to 3 percent or less.

Solvent extracted soybean meal is sold on the basis of 44 to 50 percent protein. Most of the 50 percent meal is used in the broiler industry and the 44 percent meal for livestock. Hulls may be used to help control the protein content of 44 percent meal and are used in livestock rations.

All the mills consider 12.5 percent the best moisture content for meal. In 1969, the average moisture content was 11.7 percent. The range between mills was from 10.8 percent to 12.9 percent.

Processing Costs

The costs of processing soybeans are divided into three major categories: (1) Manufacturing costs or those mostly concerned with direct processing; (2) general and administrative expense which covers overhead; and (3) financial expense—interest and bank charges.

Crushing costs vary widely with crushing capacity which ranges from 250 tons to 1,700 tons a day.

FIGURE 15.--REFINING LOSS ON CRUDE OIL PRODUCED BY COOPERATIVE SOLVENT MILLS

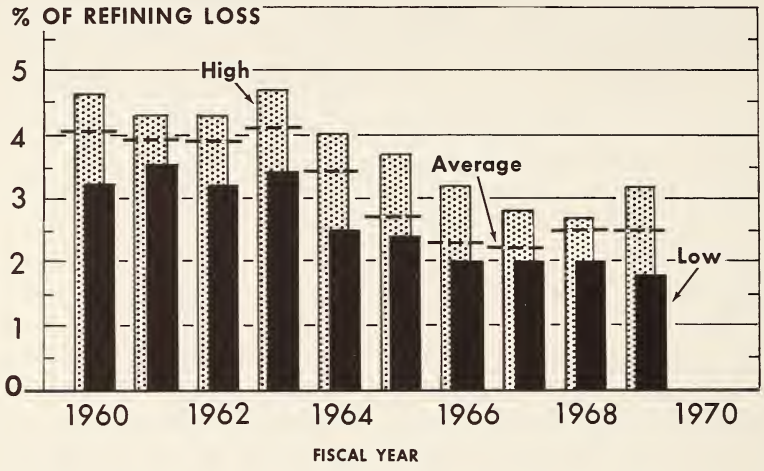


Table 19.—Kind of transportation used by cooperative soybean oil mills, fiscal 1959 through 1969

Fiscal year	Mills	Beans received			Meal shipped				Oil shipped		
		Rail	Truck		Rail	Truck		Barge	Rail	Truck	Barge[1]
			Mill	Other		Mill	Other				
	Number	Percent			Percent				Percent		
1959	4	21	23	56	42	34	24	[2]	86	14	[2]
1960	6	18	28	54	34	31	35	[2]	88	12	[2]
1961	8	52	9	39	55	13	32	[2]	77	23	[2]
1962	7	46	11	43	50	14	36	[2]	75	25	[2]
1963	8	51	13	36	56	15	29	[2]	74	26	[2]
1964	8	53	11	36	59	17	24	[2]	69	1	30
1965	10	48	10	42	46	13	41	[2]	55	1	44
1966	10	52	10	38	50	15	21	14	56	4	40
1967	11	51	9	40	51	14	21	14	54	4	42
1968	11	56	9	35	62	13	20	5	51	2	47
1969	12	58	12	30	54	15	18	13	50	5	45

[1] Includes truck-barge combination.
[2] Not available.

Operating other departments—such as feed milling or grain marketing—can help absorb overhead. Even methods used in allocating overhead can be a factor.

Wage rates are much higher in some areas than in others. The age and arrangement of machinery within a mill can affect the amount of labor required. Processing plants with feed mills attached have the opportunity to transfer meal at very low cost as well as interchange labor. Although cooperatives ship about 92 percent of soybean meal produced in bulk, some mills sell 10 percent or more in sacks. This requires additional investment and also increases operating costs.

In calculating income, costs, and margins information for cooperative soybean processors, it has been the practice to include freight on beans as well as hedging gains or losses as a part of the price of beans.

In the same manner, hedging gains or losses and brokerage have been taken into account in the oil price and income. The same is true of meal including cost of bags and twine and any outbound freight.

Transportation

Although transportation cost data have not been calculated as a separate item, information has been compiled on the kind of

Loading dock area of modern warehouse at Boone Valley Cooperative Processing Association, Eagle Grove, Iowa. This association operates a truck fleet for receiving soybeans from local elevators and shipping meal.

transportation cooperative mills use (table 19). The proportion of beans received by rail has increased considerably with a consequent decrease in beans trucked. This shift has been due to increased use of hopper cars.

In 1966, about 15 percent of the total bean receipts were in hopper cars and about 29 percent of considerably larger receipts in 1969. Hopper car receipts are much higher at southern than at midwestern mills.

Two associations that operate relatively large truck fleets and receive no beans by rail account for most of the receipts in company-owned trucks.

As with soybeans, rail shipments of meal have increased as more hopper cars are used. Hopper shipments rose from less than 30 percent of total shipments in 1966 to 44 percent in 1969. Again, the heavy use of hopper cars is by southern mills.

Meal shipment in company-owned trucks has remained fairly constant in recent years. Two mills ship no meal by rail.

Barge shipment of meal has come into the picture and cut into the truck business.

Both rail and truck shipments of oil have declined but about half still moves by rail. More than 90 percent of the rail movement is in jumbo tank cars. Barge movement, including truck-barge combination, has been increasing and currently account for about 45 percent of total shipments.

Manufacturing Costs

In recent years direct processing has accounted for approximately 70 percent of total crushing cost.

The average direct cost for all mills generally declined from 1959 through 1966 but has been increasing since that time (figure 16). The low in the 11-year average was 12.01 cents a bushel in 1966 and the high was nearly 17 cents in 1959. Between mills, the high cost usually was about twice the low.

Labor Costs—Wages, including fringe benefits, are the major single cost item in direct processing expense and account for about 30 percent of the total. Wage rates, size, arrangement, and lay-out of mill, amount of overtime worked, and the like all enter into the labor cost.

During the 7-year period 1959 through 1965, labor cost per bushel showed a general decline. Since then, the trend has been upward (table 20). Even so, labor cost per bushel, on the average, has not exceeded 5 cents a bushel since 1960. In most years, the high cost mill exceeded the low cost mill by about 2 cents a bushel.

For the past several years, the cooperative mills have carried on labor utilization studies. All these have been made in the fall during harvest or heavy bean receiving season when labor requirements are at their peak. Normally, this is also the season with the highest crush.

FIGURE 16.--TOTAL MANUFACTURING COST PER BUSHEL FOR SOYBEANS PROCESSED BY COOPERATIVE SOLVENT MILLS

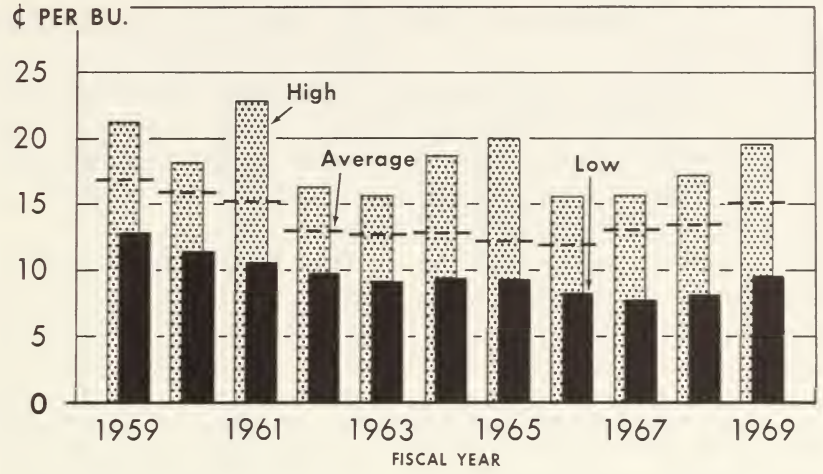


Table 20.—Labor cost[1] per bushel of soybeans processed by cooperative mills, fiscal 1959 through 1969

Fiscal year	*Mills*	*Cost per bushel*		
		High	*Low*	*Average*
	Number		*Cents*	
1959	4	7.57	5.03	6.00
1960	6	6.15	5.19	5.55
1961	8	6.59	3.43	4.18
1962	7	5.98	2.98	3.77
1963	8	5.07	2.93	3.66
1964	9	5.71	3.14	3.94
1965	10	5.44	3.10	3.66
1966	9	5.07	2.80	3.76
1967	10	5.45	2.95	4.11
1968	10	5.28	3.02	4.46
1969	12	6.26	3.49	4.91

[1] Includes all fringe benefits.

To obtain the information, each mill kept records on each employee for a 14-day period. Each record showed job description; regular and overtime wage rates; regular and overtime hours worked at each job; shift or shifts the employee worked; and gross and over time pay. The mill also recorded bushels crushed each of the 14 days.

In the fall of 1969, about 54 percent of the hours worked at 11 mills were on the first shift, 23 percent on the second, 12 percent on the third, and 11 percent by swing men on the various shifts.

For the same period, about 32 percent of the hours were spent in the extraction department, 22 percent in the meal departments, 17

percent each in the maintenance and elevator departments, and 2 percent by superintendents. The remaining 10 percent includes oil loaders, boiler operators, yard and clean-up, and so on.

Hours worked by department varied considerably among the mills. In most, extraction required the most hours. However, in one or two mills more hours were used in the meal or maintenance departments. In one, the most hours were at the elevator.

Some of the major indicators of labor utilization for the 2-week periods for which records were kept in the last 11 years are shown in table 21.

Overtime varied considerably over the years with some downward trend in recent years and large differences between the low and high mills. Generally mills with the least overtime were those with the high wage rates and mills with the most overtime were those with lower wage rates. Machinery breakdowns of any duration usually result in excess overtime.

At least one mill has a contract that guarantees each employee 48 hours of work a week, 8 of these overtime. An extremely heavy run of beans during harvest can also result in much overtime.

Bushels crushed per man-hour more than doubled between 1959 and 1965 but this has declined some since then. The condition of the beans being crushed, as well as downtime, can affect this. Between mills, the smaller plants usually have the lowest crush per man-hour with the larger, more automated mills getting the highest throughout.

In 1965, wage cost per bushel hit its lowest point for the 11-year period. Since then, this cost per bushel has shown an upward trend because of the reduced crush per man hour and increased wage rates.

The average wage cost per bushel for these 2-week periods was lower than the yearly averages for two primary reasons: (1) The mills had taken their downtime for maintenance and repair before the 2-week period so the mill was likely to operate more efficiently, and (2) with large receipts at harvest and usually a fairly good processing margin, the pressure was on to process as many beans as possible.

As would be expected, the average hourly wage has shown an almost continuous upward trend. The average for all mills increased from $1.91 an hour in 1959 to $2.99 in 1969, an increase of 57 percent. The average for the low mill increased 54 percent, for the high mill, 61 percent.

Depreciation—After labor, depreciation is the next largest item in manufacturing costs. This item made up 22 percent of manufacturing cost in 1969. Age, size, and cost of plant and equipment; size and cost of storage space; and method of depreciation are the principal factors determining depreciation cost.

Table 21.—Labor utilization, cooperative soybean oil mills, 14-day periods, 1959 through 1969[1]

Year	Mills	Bushels crushed per man-hour			Average hourly wage rate			Wage cost per bushel			Overtime wages as percentage of total wages		
		High	Low	Average	High	Low	Average	High	Low	Average	High	Low	Average
	Number	Bushels			Dollars			Cents			Percent		
1959	5	52.9	23.6	42.0	2.43	1.57	1.91	6.64	3.56	4.56	32.6	13.5	21.2
1960	8	117.6	19.1	64.0	2.65	1.51	2.11	8.07	2.27	3.30	41.4	1.0	23.0
1961	8	126.8	16.0	72.1	2.67	1.53	2.07	9.57	2.11	2.87	27.6	1.8	19.8
1962	7	134.6	49.7	81.9	2.79	1.64	2.18	3.32	2.07	2.66	33.9	3.5	25.6
1963	9	146.7	50.9	85.3	2.95	1.67	2.29	3.57	2.01	2.69	36.0	1.1	19.9
1964	10	122.7	59.4	91.9	3.12	1.79	2.35	3.69	1.65	2.56	43.3	2.5	23.1
1965	9	167.8	83.6	109.1	3.12	1.81	2.43	3.16	1.26	2.23	31.6	4.7	17.1
1966	10	135.6	47.1	81.2	3.29	2.01	2.48	4.61	1.88	3.06	31.5	0.1	19.6
1967	10	129.0	42.8	94.4	3.45	2.25	2.71	5.27	2.05	2.87	31.3	0.1	16.6
1968	10	139.6	54.4	96.9	3.80	2.42	2.96	4.70	1.84	3.05	30.8	1.4	21.1
1969	11	142.0	54.8	92.5	3.92	2.41	2.99	4.77	2.29	3.23	25.0	2.7	16.4

[1] Based on records kept on each employee during a 14-day period in the fall of each year.

Depreciation cost per bushel of beans crushed declined gradually from 1959 until 1967 but increased some in the next 2 years (figure 17). Remodeling old plants, installing new product processing equipment, and building new plants has brought the cost back to near 3 cents a bushel where it was in the early 1960's.

Utilities—Power, electric, and water costs per bushel of beans crushed have declined in the 11-year period since 1959 (table 22). In 1969, the average cost was about 1.5 cents a bushel compared to approximately 2 cents at the beginning of the period.

Part of this decline in cost is attributable to new plants coming into production in the South where rates are generally lower. Another factor is a graduated schedule of rates in effect at all the mills with a decreasing cost per unit as consumption increases. This item varies less than many of the other costs among the mills.

Fuel—Unlike electric costs, fuel costs have generally trended upward (table 22) and now exceed electric costs. This has been due primarily to installation and use of driers to condition high moisture beans for safe storage. Further processing of oil at four mills also increased fuel use.

In most cases, fuel cost at the

FIGURE 17.--DEPRECIATION COST PER BUSHEL FOR SOYBEANS PROCESSED BY COOPERATIVE SOLVENT MILLS

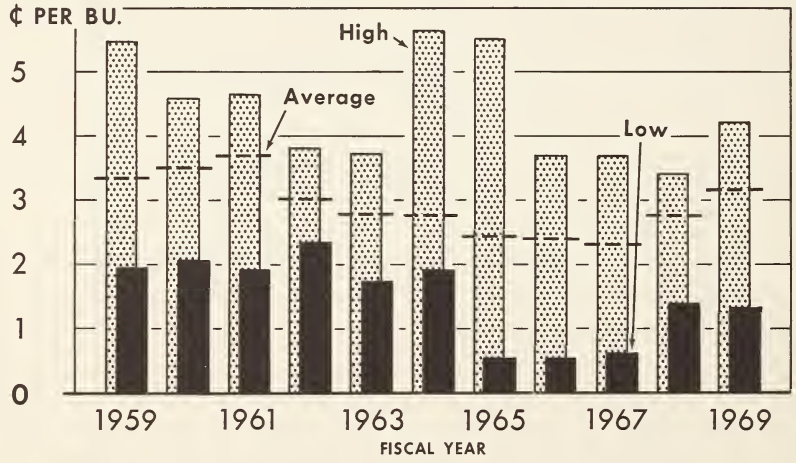


Table 22.—Power, electric, and water costs and fuel cost per bushel of soybeans processed by cooperative mills, fiscal 1959 through 1969

Fiscal year	Mills	Power, electric, water costs			Fuel cost		
		High	Low	Average	High	Low	Average
	Number	Cents per bushel					
1959	4	2.18	1.66	2.02	2.23	1.30	1.61
1960	6	2.22	1.31	1.89	1.82	.73	1.19
1961	8	2.40	1.12	1.65	1.74	.85	1.39
1962	7	2.38	1.21	1.58	1.64	.78	1.36
1963	8	2.14	1.04	1.57	2.20	1.10	1.42
1964	9	2.14	1.03	1.50	2.11	.88	1.44
1965	10	1.89	1.05	1.51	2.37	1.18	1.51
1966	9	1.82	.90	1.41	1.87	.95	1.46
1967	10	1.99	.91	1.54	1.93	.90	1.56
1968	10	2.23	.88	1.49	2.04	.82	1.62
1969	12	2.02	.91	1.53	2.87	1.10	1.80

high mill has been at least double that at the low mill.

The four items discussed—labor, depreciation, utilities and fuel—make up about 75 percent of total manufacturing cost. The only other item that exceeded 1 cent a bushel was repair cost. Insurance, property taxes, and solvent were about 0.6 cent a bushel.

Administrative Costs

Administrative or overhead costs include office salaries, travel, directors' fees and meetings, advertising, dues and subscriptions, communications, office supplies, legal and audit costs, and miscellaneous. These items make up about 15 percent of the total processing cost.

Administrative costs have been less than 3 cents a bushel on the average since 1960, with those at the low cost mill consistently less than 2 cents a bushel. The high cost mill was over 3.5 cents each year (table 23).

Salaries, including bonuses and fringe benefits, have been by far the largest cost item in the administrative category (figure 18). Over the 11-year period salaries accounted for about 60 percent of total overhead cost. The average cost for all mills has been less than 2 cents a bushel each year with the exception of 1959. Between mills, the low cost mill was 1 cent or less in 6 of the 11 years. On the other hand, the high cost mill had a range from 2.31 cents to 3.34 cents a bushel.

In 1969, no other item in the overhead category was as much as .3 cent a bushel.

Table 23.—General and administrative cost per bushel of soybeans processed by cooperative mills, fiscal 1959 through 1969

Fiscal year	Mills	Cost per bushel		
		High	Low	Average
	Number		Cents	
1959	4	6.39	1.95	4.06
1960	6	5.60	2.31	3.31
1961	8	6.21	1.80	2.56
1962	7	3.76	1.51	2.28
1963	8	3.65	1.67	2.51
1964	9	4.16	1.91	2.71
1965	10	3.62	1.66	2.33
1966	9	5.88	1.77	2.89
1967	10	4.08	1.77	2.69
1968	10	3.65	1.84	2.45
1969	12	3.71	1.56	2.88

Financial Expense

Financial expense at cooperative soybean mills is primarily interest on facility, operating, and commodity loans. Also included are bank charges and in some cases these are substantial. Financial expenses are currently about 18 percent of the total processing cost.

In the 11-year period ending in 1969, the average financial expense per bushel of beans crushed by all mills varied from 1.41 cents in 1959 to 5.06 cents in 1965 (figure 19).

Variation between the high and low cost mills was great. The low mill had less than 1 cent a bushel cost in 8 of the 11 years while the

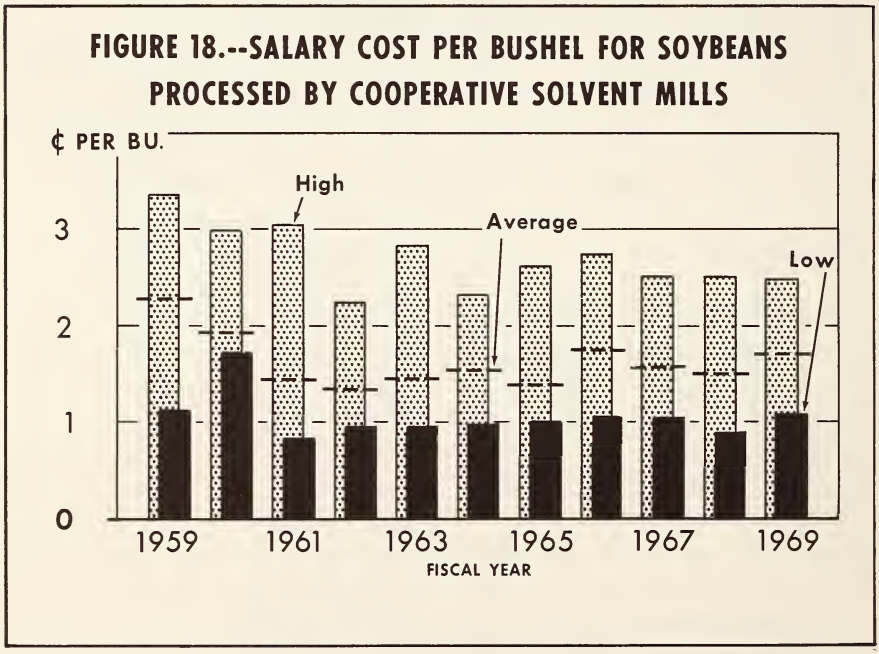
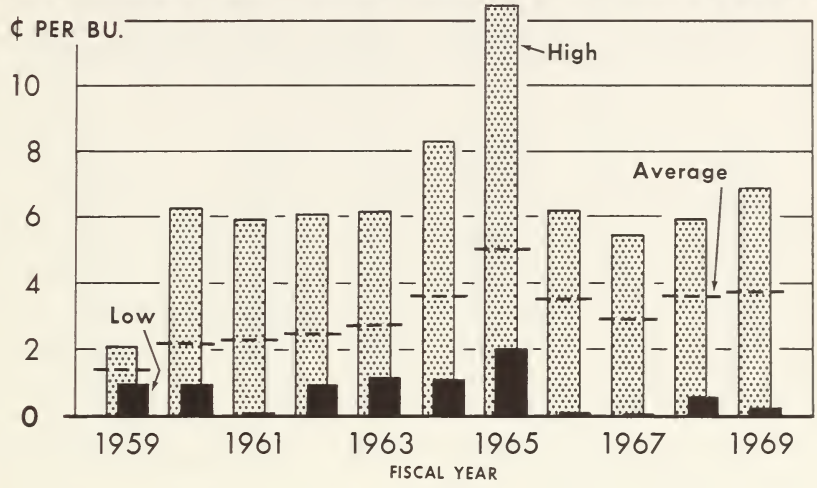


FIGURE 19.--INTEREST AND BANK CHARGES PER BUSHEL FOR SOYBEANS PROCESSED BY COOPERATIVE SOLVENT MILLS



high mill had a cost in excess of 5 cents a bushel in all except one year.

The high interest costs were at southern mills. In general, building grain storage facilities has not kept pace with the increased production of grain in the South and Southeast and there is also the pull of the export market. In view of this, processing plants in the area have had to build much more storage in relation to their annual crushing requirements than the mills in the North where country elevators do much of the storing. Providing this additional storage adds to the interest cost.

Also southern mills acquire the great bulk of their bean requirements at harvest; otherwise the beans move out of the area, mostly for export. This means carrying a large inventory over a long period of time and involves huge sums of money. Present high interest rates make costs very high at these mills.

Total Processing Costs

Total processing costs averaged 21.83 cents per bushel of soybeans processed in 1969. This was 2.2 cents a bushel or 11 percent over 1968 and was the first year since 1960 that cost had exceeded 20 cents a bushel (table 24). A 3-month strike at one of the larger plants and the start-up of one new plant were responsible for much of the increase in 1969.

Table 24.—Total processing cost per bushel of soybeans processed by cooperative mills, fiscal 1959 through 1969

Fiscal year	Mills	Cost per bushel			Difference between high and low
		High	Low	Average	
	Number	Cents per bushel			
1959	4	29.60	15.74	22.43	13.86
1960	6	25.87	14.74	21.55	11.13
1961	8	30.80	17.97	19.99	12.83
1962	7	22.44	13.04	17.68	9.40
1963	8	22.37	12.72	17.96	9.65
1964	9	29.61	13.97	19.20	15.64
1965	10	35.16	13.37	19.59	21.79
1966	9	23.30	10.58	18.38	12.72
1967	10	22.62	10.28	18.70	12.34
1968	10	25.37	11.65	19.63	13.72
1969	12	26.10	13.55	21.83	12.55

The variation was wide between the high and low cost mills during this period. In several of the years, costs at the high mill were more than double those at the low mill.

Although there has been an upward trend in the general price level in the last 11 years, soybean cooperatives have maintained fairly stable costs through economics of scale and improved technology.

Other Services

In addition to their primary function of processing cottonseed and soybeans, some cooperative mills process other oilseeds. They also carry on sideline activities for members, such as handling supplies and making operating loans.

Cottonseed Mills

Some cottonseed mills in livestock areas mix feed for sale to local ranchers and feeders. This ranges from "20-80" mix which utilizes meal and hulls from cottonseed processing to complete mixed feed at a plant operated by Ne-Tex Cooperative Oil Mill at Wolfe City, Tex. In 1969 five mills sold mixed feed.

Operating Loans

Most cooperative cottonseed

mills advance operating capital to their member gins during the summer and fall so they can make repairs and meet operating costs before the ginning season begins. In most cases these loans are repaid from seed returns due the gins.

Usually gins do not need all their seed returns before early spring and a growing practice is to leave funds with the mills. The mills pay interest on the funds and member gins can withdraw them on demand.

Other Oilseed Processing

Soybean processing is increasing among cottonseed mills. Before 1963, only one cottonseed mill crushed soybeans on a regular basis. By 1969 there were five. Three of these mills converted from screw press to solvent operations in order to supplement their cottonseed volume with soybean crushing.

Cottonseed mills in soybean production areas can reduce their fixed costs by crushing soybeans in years of short cotton production. Soybean producers also benefit by marketing through cooperative processing channels. This benefit to producers is especially significant in areas in which soybeans are a new crop and production is not sufficient to support a soybean oil mill.

The Plains Cooperative Oil Mill, in addition to crushing soybeans, owns and operates a castorbean processing plant at Plainview, Tex.

Ranchers Cotton Oil markets, and in some years processes, safflower for its members.

Other Activities

The Valley Co-op Mill at Harlingen, Tex., operates a chemical mixing plant as a separate operating division of the oil mill.

In 1969, 11 cottonseed mills handled over a $2 million volume of bagging and ties for member gins. A mill usually can obtain a lower purchase price by ordering large quantities. A seed truck can backhaul bagging and ties from the mill during the cottonseed movement thereby reducing transportation costs. Also, in times of scarcity, mills may be able to obtain bagging and ties when individual gin members cannot.

Soybean Mills

Some cooperative soybean mills perform additional services for their producer-members.

Goldkist Inc., with Gold-Kist Soy as a division, operates a number of peanut drying and shelling plants across the South. It also operates peanut crushing plants and six feed mills.

Farmers Union Grain Terminal Association, with Honeymead Products as a division, operates a

flaxseed processing plant. It crushes sunflower seed in the same plant with the oil being refined and hydrogenated by Honeymead Products. Honeymead also produces soy flour and grits for industrial uses, operates a durum flour mill, two malting barley plants, several large feed mills, and lumber and building supply stores.

Boone Valley Cooperative Processing Association operates a large feed mill in addition to a new 1,500-ton-a-day soybean processing plant.

Missouri Farmers Association, in addition to its soybean processing plant at Mexico, Mo., operates a number of feed mills, manaufactures and distributes fertilizer, and handles farm supplies.

Land O'Lakes, Inc., operates a soybean processing plant and feed mill at Sheldon, Iowa, and a number of other feed mills in the upper Midwest.

Far-Mar-Co., Inc., in addition to operating a soybean processing plant at St. Joseph, Mo., has doubled the capacity of its bulgur processing plant at Hutchinson. Through its data processing division, it keeps complete records for many of its local cooperative elevator members.

Member and Public Relations

Cooperative soybean and cottonseed oil mill officials recognize the need for continued member and public support.

Membership relations activities include keeping members informed on their association's operation and goals.

Public relations center around oil mill officials taking an active part in affairs of their towns and communities and in their respective industry associations.

Keeping Members Informed

The geographical area served by cooperative mills varies widely. In some cases member gins and elevators are relatively close to the mill and patrons can easily contact mill officials personally and by telephone. However, if gins and elevators are scattered over greater distances, considerable effort must be spent on information activities.

Field Staff and Board of Directors

All the cooperative mills recognize the need for personal contacts. In 1969 most cooperative cottonseed mills and all the soybean mills employed at least one full-time field representative.

Field representatives are important links between mill manage-

ment and patrons. Other communications and educational techniques supplement but do not take the place of frequent personal contacts.

In addition to having general responsibility for maintaining flow of information between management and members, field representatives perform various other duties. They call on prospective members, attend and speak at local gin and elevator members' annual meetings, and in some areas sell meal, hulls, and feed manufactured by the mill.

One fieldman for a cottonseed mill is a competent accountant and assists member gins in bookkeeping procedures.

Another important personal contact between mill management and members is through the board of directors. Members who know directors personally frequently come to them with questions and suggestions or to get information. A knowledgeable director performs a valuable service to his cooperative by maintaining these contacts. This is the reason some mills have such large boards.

Annual Meetings and Reports

In areas where membership is widely scattered, the annual meeting is one of the few opportunities many patrons have for direct contact with mill personnel.

Several factors should be considered in planning an annual meeting. One question to answer is—are the selected date and site convenient for most of those who will attend? A meeting held at the location of the mill has an advantage in that patrons can view physical facilities. Sometimes, however, another location may be more convenient for most patrons.

Business sessions should be pitched at the level of understanding of the majority of those attending. Several cooperatives distribute condensed financial statements which help members follow the auditor's report.

Attendance at the annual membership meeting of federated cottonseed mills usually ranges from 200 to 650 persons. The program generally consists of officers' reports, a review of financial statements, election of directors, action on resolutions, and featured speakers.

Most multipurpose cooperatives that operate soybean processing plants have annual meetings that last from 2 to 4 days. Attendance varies from 2,000 to 8,000 people—so many that only larger cities can provide adequate accommodations. Other cooperative soybean processors usually have a 1-day annual meeting with attendance from 200 to 2,000.

Most soybean cooperatives issue comprehensive annual reports containing not only financial and operating information but also reports of officials of the cooperative and resolutions to be

Member patrons of Farmers Cooperative Oil Mill, El Paso, Tex., at an annual meeting dinner.

considered. These reports are widely distributed to producers and to various State and Federal agencies concerned with agriculture and cooperatives.

Other Membership Activities

Cooperatives take several other means to inform members of their activities.

Some cooperative cottonseed mill managers write membership letters on a regular basis, usually monthly. Others write such letters as needed for specific purposes.

None of the cottonseed oil mills have membership publications. Two mills, however, submit articles and news items to publications of regional cotton cooperatives.

One cottonseed mill joins with other regional cotton cooperatives in sponsoring farm educational programs on radio and television.

Seven soybean cooperatives have membership publications, most issued monthly.

Some soybean cooperatives hold district meetings throughout their territory to help keep the members informed.

Several cooperatives call their local elevators each day after the futures market closes to give them their bid prices. Others send out bid cards daily. Still others announce prices over radio at specified times each day. Of course, there are many direct calls each day between the locals and mills regarding prices on beans and meal, selling and buying orders, shipments, and the like.

As mentioned earlier, Arkansas Grain Corporation operates on a pool basis and makes an advance

on beans as they are received at harvest. As products are manufactured and sold and as financial conditions warrant, additional advances are made. These are timed to coincide with periods when members are likely to need money. Thus the producer may receive a check before Christmas, before income tax deadline, at spring fertilizer-buying time, at summer vacation time, and the final payment check in early September just before the new harvest. This advance payment system is an extremely effective membership relations program.

Since co-op members usually spend the money in their own communities, the whole business economy of the area is improved. This is good public relations and also enhances the image of cooperatives.

Public Relations

Cooperative oil mill officials strive to be of public service by taking part in community and industry affairs. By participating in local and area activities, they let the public see that the cooperative wants to be a part of the community—not isolated from it.

Community Activities

Almost all oil mill officials belong to their local Chambers of Commerce and several serve as directors. They also belong to various associations such as Rotary, Kiwanis, Elks, and Lions.

Oil mill officials speak to community groups on cooperatives and agricultural business. Some mills permit local clubs to use their directors' room as a meeting place. Many oil mills invite local businessmen to attend the association's annual meeting.

All the cooperative oil mills give farm youth activities a high priority. Mills participate by making donations and working with FFA chapters and 4-H clubs. They promote and sponsor livestock feeding contests and shows and crop-producing contests; they also furnish prize money.

The interest shown by cooperative oil mills in community affairs has resulted in favorable public attitudes toward them and toward agricultural cooperatives.

Work in State and National Groups

Most cooperative mills are members of and take an active part in State and national commodity and processor associations. All but two cooperative cottonseed mills are members of the National Cottonseed Products association. Only one is not a member of the National Cotton Council.

Most cooperative soybean mills are members of the National Soy-

bean Processors Association. A number of the mill managers have been members of its board of directors and one has served as president. Most of the mills are also supporting members of the American Soybean Association whose active membership is composed of soybean growers.

Many multipurpose cooperatives that market grain are members of the U.S. Feed Grains Council and its first two presidents were employees of cooperatives.

Practically all the cottonseed and soybean mills are members of their respective State or regional crushers association.

More than half of the cooperative soybean and cottonseed oil mills are members of the American Institute of Cooperation, the National Council of Farmer Cooperatives, and the National Federation of Grain Cooperatives. Also, they are members of State cooperative councils or associations.

Several oil mill officials have served on advisory committees to the U. S. Department of Agriculture. These committees make recommendations on research pertaining to cotton, cottonseed, soybeans, and products.

Cooperation Among Cooperative Oil Mills

The establishment of close working relationships has been an important factor in the development and growth of cooperative oil mills. These mills all have the same objective—to increase farmer-patron returns from cottonseed or soybeans. Recognition of this common goal has led management of cooperative mills to work together in areas of mutual concern.

Together the two industry groups have been much more effective in working with the legislative and administrative branches of the Government than if they had been speaking separately.

Mills in both commodity groups use the advisory services of Farmer Cooperative Service (FCS). Individual mills also use the annual reports on costs, margins, and operating results prepared by FCS to compare their own operating results with those of other mills. These comparisons and resulting discussions have led to greater operating efficiency which means increasing cottonseed and soybean returns to member growers.

Cottonseed and soybean processors also have benefitted from FCS research reports on industry problems such as protein control and effects of rates on electric power costs.

Joint Conferences

Annual conferences of cooperative soybean mills began in 1948; of cottonseed mills in 1949. In 1955, the two commodity groups met together for the first time and since then have held joint annual conferences.

These annual conferences are sponsored by the cooperatives, agencies of the U.S. Department of Agriculture, and district banks for cooperatives. Farmer Cooperative Service helps arrange and conduct them. Meetings are held in various places, preferably where a tour of a cooperative mill can be part of the program. Usually the meetings are alternated between soybean and cottonseed mills, with every fourth meeting held in Washington, D. C.

A major purpose of the annual conference is to present results of current research on soybeans and cottonseed and their products carried out at the laboratories of the Northern and Southern Research and Development Divisions at Peoria, Ill., and New Orleans, La., respectively. This program has kept cooperative oil mills abreast of latest improvements in processing techniques and ways of maintaining and improving the quality of products.

In 1962 the program of the joint annual conference was expanded to include a session for superintendents. This is a workshop where each superintendent participates in the discussions. Subjects have included such areas as labor utilization, plant operating problems, employee relations, and safety programs. The superintendents' session has proved to be a valuable part of the program and attendance has been increasing each year.

Soy-Cot Sales, Inc.

An important accomplishment of the annual joint conference of cooperative oil mills was the formation in 1962 of Soy-Cot Sales, Inc., Des Plaines, Ill. This coordinated joint sales agency was organized to strengthen individual mills' marketing efforts by pooling their products to give them a greater voice in the market place. In 1969, Soy-Cot had 22 members—11 cottonseed and 11 soybean mills.

Specific goals which led to the organization of Soy-Cot were:

1. *Savings on brokerage expense.* At the time Soy-Cot Sales was organized, cooperative mills were spending about $400,000 annually for brokerage. Cost of operating a joint sales agency was estimated at $200,000. Savings of about one-half the brokerage expense therefore go back to farmers as increased returns from soybeans and cottonseed.

2. *Seller's agent.* A central sales agency represents and works ex-

clusively in members' interest. It is a marketing agency that bargains directly with buyers rather than a brokerage agency that works for both buyers and sellers.

3. *Savings on freight.* A central sales agency can reduce hauling between mills and refineries. Trainload assembly of products can also bring about lower freight rates.

Few member mills have sales volume to justify employing a traffic specialist but it was anticipated the combined volume would justify this. In its third year of operation, Soy-Cot did add a traffic specialist.

4. *Package transactions.* Often buyers must accumulate desired volume and quality through a number of small transactions. A central sales agency such as Soy-Cot can make up a package in a relatively short time and thereby be of service to a buyer.

5. *More markets.* A central sales agency, as a representative of producers, has a direct interest in establishing markets based on dependable volume, quality of products, and other long-term factors that should enhance total use of oilseed products (especially in fat deficient countries).

A long-term goal of Soy-Cot is to establish export markets and serve them on a direct basis.

6. *Increased mill efficiency.* Without a central sales agency, oil mill mangers would need to spend considerable time with several brokers to keep abreast of market conditions. Soy-Cot staff spends full time obtaining and analyzing market information and is in constant touch with mill managers. Marketing decisions are still the mill manager's responsiblity but Soy-Cot provides information on which to make these decisions. The result is that managers can spend more time on increasing the efficiency of mill operations.

In addition to the benefits listed, Soy-Cot is a base for forward integration by cooperative mills as a group. Several members are now further processing oil on an individual mill basis. It is possible that small mills which cannot do this economically on an individual basis could own and operate facilities jointly.

Soy-Cot could explore possibilities and could operate such facilities if they are determined to be feasible. Furthermore, when sufficient volume of finished products is available from member mills, Soy-Cot could serve as joint sales agency as it does currently with unfinished and semifinished products.

Trends In Cooperative Processing

Cooperative soybean and cottonseed oil mills have been moving toward large-scale modernized plants. This trend is expected to continue. Volume of soybeans and cottonseed processed by cooperatives will increase, not only from greater capacity of present plants but also by acquiring and by organizing new mills.

Increased emphasis is being placed on improved products for present and new uses. Further processing of oil by cooperative mills is growing at a rapid rate. New oilseed crops are being explored. Meal quality is being improved for animal feed and progress is being made in processing protein for human foods.

Oil Processing

More cooperative soybean and cottonseed oil mills are going into oil processing at crushing mill sites. This can be done at significantly less cost than off-mill-site processing.

Soybean Mills

Several cooperative soybean mills are engaged in further oil processing. Some of these were mentioned earlier in this report in connection with plant modernization.

Farmers Union Grain Terminal Association's Honeymead Products Division refines, bleaches, and hydrogenates the bulk of the soybean oil it produces. It also refines and hydrogenates sunflower oil produced by its Minnesota Linseed Oil Company.

Arkansas Grain Corporation is equipped to refine all oil production from its three plants.

At the two Stuttgart plants, it has equipment to refine, bleach, winterize, and hydrogenate all the oil produced. The cooperative also packages shortening ready to be placed on grocer's shelves.

Far-Mar-Co., Inc., Missouri Farmers Association, and Gold Kist Inc., are all equipped to produce degummed oil.

Cottonseed Mills

Further processing of oil at cooperative cottonseed mills began at Ranchers Cotton Oil, Fresno, Calif. in 1953. As mentioned earlier in this report, Ranchers developed commercial use of miscella processing—an entirely new approach to cottonseed oil processing.

Miscella refining has several major advantages. William Emory and Jack S. Wolf make the following statement on the process and its benefits based on a study carried

out at Washington University, St. Louis, Mo.

"This process, like the degumming operation, is most economically carried out at the seed crushing mills. Although there are some technical difficulties to the miscella refining process, it has some advantages over the regular refining methods. More effective removal of free fatty acid and decolorization of the oil can be achieved; the loss of oil is superior to that obtained by other refining methods. The bleach color is so low that it is possible often for a shortening manufacturer to eliminate the bleaching stage as part of his manufacturing procedure." (8)

Ranchers Cotton Oil extended its oil processing by developing a continuous winterizing system. Refined, winterized oil is then sent to deodorizing facilities. This allows Ranchers to go from seed to a completely finished salad oil ready for the table in one continuous on-mill-site system.

An important side benefit of the Ranchers oil processing system is production of a low gossypol meal that can be used in laying-hen-rations. Soybean meal is shipped to California from Midwestern States with freight charges of about $20 a ton. Ranchers has a freight advantage over soybean meal and over 75 percent of its meal production goes to the poultry industry. The premium on Ranchers meal over conventional cottonseed meal averages about $10 a ton. Combined economic benefits from oil processing and low gossypol meal average about $10 a ton of seed over the conventional operation of crude oil mills.

Miscella refining is spreading to other cooperative cottonseed mills. Plains Cooperative Oil Mill began miscella refining in 1965. Ne-Tex Cooperative Oil Mill converted from screw press to solvent and miscella refining facilities in 1967. Producers Cooperative Oil Mill made the same conversion in 1968. It is expected that more cooperative mills will install miscella refining facilities in the near future.

Ranchers is the only cooperative cottonseed mill that now processes oil to the finished stage. However, if miscella refining spreads to a sufficient number of smaller cooperative mills, it may be feasible to own and operate centrally located winterizing and deodorizing facilities on a cooperative basis.

New Oilseed Crops

Cooperative oil mills have shown interest in producing and processing new oilseed crops, especially sunflower.

The Cen-Tex Cotton Oil Mill, Ne-Tex Cooperative Oil Mill, and Gold Kist Inc. have encouraged trial sunflower plantings.

These mills have been participat-

ing with public institutions in supplying growing and harvest information and also in subsidizing trial plots by providing a market for sunflower seed. Minnesota Linseed Oil Company, a division of Farmers Union Grain Terminal Association, has been contracting for and crushing sunflower seed for some time.

The future of sunflower as a commercial crop in cotton and soybean growing areas depends on progress in insect and disease control, uniform maturity of the crop, and on competition from alternative crops.

Protein for Human Food

Cooperative soybean and cottonseed mills are becoming increasingly interested in producing soybean and cottonseed protein for human food uses. Several mills have taken steps in this direction.

So far as the cooperatives are concerned, there is no real conflict between soybeans and cottonseed. Because of the composition and quality of the two proteins, they will complement rather than compete with each other.

All except one of the cooperative soybean mills are equipped to produce 50 percent protein meal, the first step toward production of protein for human consumption. Several associations are considering installing equipment to produce protein for human food.

The potential of cottonseed protein for human food uses has long been known. However, the presence of toxic gossypol glands in cottonseed has been a major deterrent. Two basic approaches to the gossypol problem have been to breed commercial varieties of glandless (gossypol free) cottonseed and to develop processing techniques to remove gossypol during commercial oil mill operations.

During the past few years significant progress has been made in developing and producing commercial varieties of glandless cottonseed. Cooperative cottonseed mills have cooperated with the National Cottonseed Products Association in making their facilities available for commercial trial uses for research data.

Plains Cooperative Oil Mill, Lubbock, Tex., crushed 600 tons of "Gregg 25V" glandless seed in 1967. Producers Cooperative Oil Mill, Oklahoma City, Okla., purchased and crushed 200 tons of "Watson GL16" glandless seed in 1969. Portions of the meal manufactured in the Oklahoma City test were sent for further processing to Delta Products Company, Wilson, Ark.

Results of trial runs on glandless seed show that cottonseed flour can be produced on a commercial basis. Future prospects depend greatly upon sufficient production and supply of the glandless cottonseed varieties.(9)

The need for protein for human consumption exists not only in this country but around the world. Cooperative cottonseed and soybean mills have both the potential and interest to meet a part of this need.

Appendix

Increase in revenue for solvent over screw press operations per ton of seed crushed can be estimated from the following formula:

$$y = t\,(x - z) - uw$$

where y = increase in revenue per ton of seed
t = increase in pounds of oil per ton of seed
(t = 27 for direct solvent)
(t = 36 for prepress solvent)
x = price of crude oil (¢ per lb.)
z = hull price (¢ per lb.)
u = premium for screw press meal ($ per ton)
w = meal yield (fraction of ton of meal per ton of seed)

The formula does not account for differences in investment and operating costs. These need to be determined to get a complete measure of relative economic efficiency. However, the formula is useful in determining the amount of increased revenue that would be generated to pay for increased investment and operating costs.

For example, a screw press mill averaging 40,000 tons annual crush under projected 12 cent oil, $20 hulls, 950 pounds meal yield, and $2 premium for screw press meal would increase per-ton revenue by conversion to direct solvent as follows:

$y = 27\ (12¢ - 1¢) - \$2\ (0.475)$
$y = \$2.97 - \$0.95$
$y = \$2.02$ per ton crushed
40,000 y = $80,800 annual increase in revenue

If solvent meal was not discounted, the increase in gross revenue would be $2.97 a ton of seed or an annual increase of $118,800. Further, if estimated oil price was 13 cents, then annual increase in revenue would be $129,600.

The following three tables give estimated net increases at no premium for screw press meal and at $1 and $2 a ton premiums.

Appendix Table 1.—Cottonseed: Increases in revenue, no premium for screw press meal: Prepress over screw press, direct solvent over screw press, prepress over direct solvent; by selected crude oil prices and sizes of annual crush[1]

Crude oil price	*40,000 tons crush*			*50,000 tons crush*			*60,000 tons crush*		
	Prepress over screw press	*Direct solvent over screw press*	*Prepress over direct solvent*	*Prepress over screw press*	*Direct solvent over screw press*	*Prepress over direct solvent*	*Prepress over screw press*	*Direct solvent over screw press*	*Prepress over direct solvent*
Cents per lb.					*Dollars*				
8	100,800	75,600	25,200	126,000	94,500	31,500	151,200	113,400	37,800
9	115,200	86,400	28,800	144,000	108,000	36,000	172,800	129,600	43,200
10	129,600	97,200	32,400	162,000	121,500	40,500	194,400	145,800	48,600
11	144,000	108,000	36,000	180,000	135,000	45,000	216,000	162,000	54,000
12	158,400	118,800	39,600	198,000	148,500	49,500	237,600	178,200	59,400
13	172,800	129,600	43,200	216,000	162,000	54,000	259,200	194,400	64,800
14	187,200	140,400	46,800	234,000	175,500	58,500	280,800	210,600	70,200
15	201,600	151,200	50,400	252,000	189,000	63,000	302,400	226,800	75,600

[1] Based on $20 a ton hull prices, and 950 pounds meal yield (41% protein).

Appendix Table 2.—Cottonseed: Increases in revenue; $1 a ton premium for screw press meal; Prepress over screw press, direct solvent over screw press, prepress over direct solvent; by selected crude oil prices and sizes of annual crush[1]

Crude oil price	40,000 tons crush			50,000 tons crush			60,000 tons crush		
	Prepress over screw press	Direct solvent over screw press	Prepress over direct solvent	Prepress over screw press	Direct solvent over screw press	Prepress over direct solvent	Prepress over screw press	Direct solvent over screw press	Prepress over direct solvent
Cents per lb.					Dollars				
8	81,800	56,600	25,200	102,250	70,750	31,500	122,700	84,900	37,800
9	96,200	67,400	28,800	120,250	84,250	36,000	144,300	101,100	43,200
10	110,600	78,200	32,400	138,250	97,750	40,500	165,900	117,300	48,600
11	125,000	89,000	36,000	156,250	111,250	45,000	187,500	133,500	54,000
12	139,400	99,800	39,600	174,250	124,750	49,500	209,100	149,700	59,400
13	153,800	110,600	43,200	192,250	138,250	54,000	230,700	165,900	64,800
14	168,200	121,400	46,800	210,250	151,750	58,500	252,300	182,100	70,200
15	182,600	132,200	50,400	228,250	165,250	63,000	273,900	198,300	75,600

[1] Based on $20 a ton hull price, and 950 pounds meal yield (41% protein).

Appendix Table 3.—Cottonseed: Increases in revenue, $2 a ton premium for screw press meal: Prepress over screw press, direct solvent over screw press, prepress over direct solvent; by selected crude oil prices and sizes of annual crush[1]

Crude oil price	*40,000 tons crush*			*50,000 tons crush*			*60,000 tons crush*		
	Prepress over screw press	*Direct solvent over screw press*	*Prepress over direct solvent*	*Prepress over screw press*	*Direct solvent over screw press*	*Prepress over direct solvent*	*Prepress over screw press*	*Direct solvent over screw press*	*Prepress over direct solvent*
Cents per lb.					*Dollars*				
8	62,800	37,600	25,200	78,500	47,000	31,500	94,200	56,400	37,800
9	77,200	48,400	28,800	96,500	60,500	36,000	115,800	72,600	43,200
10	91,600	59,200	32,400	114,500	74,000	40,500	137,400	88,800	48,600
11	106,000	70,000	36,000	132,500	87,500	45,000	159,000	105,000	54,000
12	120,400	80,800	39,600	150,500	101,000	49,500	180,600	121,200	59,400
13	134,800	91,600	43,200	168,500	114,500	54,000	202,200	137,400	64,800
14	149,200	102,400	46,800	186,500	128,000	58,500	223,800	153,600	70,200
15	163,600	113,200	50,400	204,500	141,500	63,000	245,400	169,800	75,600

[1] Based on $20 a ton hull price; and 950 pounds meal yield (41% protein).

Appendix Table 4.—Illustrative calculations of break-even prices for two hypothetical mills when changing delinting cut from 3% to 1% residual linters left on seed

Item	Unit	Mill A			Mill B			Your mill		
		Unit price	*Units per 100 lbs. of lint*	*Cost per 100 lbs. of lint*	*Unit price*	*Units per 100 lbs. of lint*	*Cost per 100 lbs. of lint*	*Unit price*	*Units per 100 lbs. of lint*	*Cost per 100 lbs. of lint*
				Cents			*Cents*			*Cents*
Hulls (reduction in hull revenue)	Ton	$25.00	100 lbs.	125.0	$10.00	100 lbs.	50.0	——	——	——
Power to linter stands	Kwh	1.5¢	45 kwh	67.5	0.44¢	45 kwh	19.8	——	45 kwh	——
Bagging & ties[1]	Pattern	$1.48	.167	24.7	$0.56	.167	9.3	——	——	——
Operating labor[2]	Man-hour	$1.25	.32	40.0		No change	0	——	——	——
Linter saws[3]	Saw disc	$0.60	.1	6.0		No change	0	——	——	——
Gummer files[3]	Gummer file	$0.20	.3	6.0		No change	0	——	——	——
Maintenance[4]	—	—		—			—	——	——	——
Other[5]	—	—		—			—	——	——	——
Total				269.2			79.1			
Break-even price per pound of chemical linters[6]				2.7¢			0.8¢			——

[1] Unit price of bagging and ties is purchase price less value of bagging and ties (weight of baggings and ties multiplied by price of linters). Purchase price at Mill A assumed to be $1.90 less 14 lbs. at 3¢ linter price. Purchase price at Mill B assumed to be $0.89 less 11 lbs. at 3¢ linter price.

[2] For illustrative purposes, Mill B can increase linter production without any change in operating labor; whereas Mill A must add 1 man to the second and third shifts. Assuming 5,000 lbs. increased linter yield, cost per 100 lbs. of increased linters is 40¢

$$\frac{\text{(16 man-hours x \$1.25 per hour)}}{\text{5,000 lbs. of linters}}$$

[3] It is assumed that Mill B does not change saw filing schedule; therefore, it would have no change in wear on saws or gummer files.

[4] Changes in maintenance and other costs could not be estimated from available data.

[5] Includes power for baling press, lube oil and grease, and other miscellaneous items.

[6] Break-even price obtained by dividing cost for 100 pounds of linters by 100.

Source: Perdue, Elmer J., and Clark, S. P. 1965. Economics of Delinting Cottonseed to Law Residual Linters at Oil Mills. U.S. Dept. Agr., Farmer Coop. Serv., Mktg. Res. Rpt. 720.

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